BOSTON PUBLIC LIBRARY
3 9999 10255 805 1

№ 3847.32

THE TRVSTEES OF THE
PVBLIC LIBRARY
OMNIVM
LVX
CIVIVM
OF THE CITY OF
BOSTON
1852 1878

MOSSES

WITH A HAND-LENS

3847.32

A Non-Technical Handbook of the More Common and More Easily Recognized Mosses of the North-Eastern United States

BY

A. J. GROUT, Ph. D.

BOYS' HIGH SCHOOL, BROOKLYN, N. Y.

ILLUSTRATED BY

MARY V. THAYER

PUBLISHED BY THE AUTHOR

360 Lenox Road, Flatbush

NEW YORK CITY

1925

COPYRIGHTED 1900 BY A. J. GROUT, PH. D.

ALL RIGHTS RESERVED

NOV 26 1901

PRESS OF
BINGHAMTON REPUBLICAN

PREFACE

MOSSES are individually so small and inconspicuous that the effect which they have as a mass in creating and enhancing the beauty of natural scenery is often overlooked. Yet if one recalls the desolate and uninviting appearance of a wood in which the mosses have been destroyed by fire, or observes carefully the part which mosses play in completing the attractions of mountain scenery, he will feel like saying a hearty amen to Ruskin's enthusiastic words in the closing paragraphs of his essay on "Leaves Motionless."

The freshness which a summer shower brings to the landscape is largely due to the unfolding of the mosses on tree and fence and boulder from patches of lifeless brown into soft cushions of living green.

Many lovers of nature have observed the beauty of mosses and have collected them for their beauty alone. Many more would have collected and studied them had not the difficulties been so numerous and hard to overcome. Until very recently there has been no literature in the English language that was suited to the needs of the beginner. Owing to the small size of most mosses, the characters which separate species and even genera are so largely microscopic that a compound microscope has been considered an absolute necessity for their study.

Many years of study of mosses in the field and in herbaria have convinced the author that any person of average intelligence can easily learn to recognize seventy five to one hundred common mosses with the aid of an ordinary hand-lens of ten to fifteen diameters magnifying power.

The purpose of this work is to give, by drawings and descriptions, the information necessary to enable any one interested to become acquainted with the more common mosses with the least possible outlay of time, patience, and money. The drawings were made without the aid of the compound microscope in order that nothing might be represented that is not readily distinguished with the simple microscope.

Finally it must be borne in mind by the student that the present work is limited and incomplete in its treatment, and is but a stepping stone to the larger and more complete works, and to the broader and fuller study of bryology.

A. J. GROUT,
BOYS' HIGH SCHOOL,
BROOKLYN, N. Y.

AUGUST, 1900.

INTRODUCTION

SO many different kinds of plants are called mosses that it may be well to clear the field by defining the true mosses as distinguished from the other plants popularly called mosses.

The sea weeds or marine algæ are often known as sea mosses, but no true moss grows in salt water.

The moss which drapes the trees in swampy regions of the South is not a true moss, but a flowering plant bearing flowers and seeds like a rose or a geranium.

Lichens are frequently confused with mosses, but they never bear leaves and never are of a bright green, but a grayish or brownish green, rarely black or bright colored. The majority of species consist of a flat thin body usually prostrate and closely applied to the substance upon which the plant grows (substratum). The "Reindeer Moss" is a lichen with shrubby hollow stems; the gray "moss" that hangs from the limbs of trees in Northern swamps is also a lichen.

The Hepaticæ, or liverworts, are most closely allied to the mosses and some species are difficult to distinguish from them. In general, however, the liverworts consist of a flat expanded body like a bright green lichen, or, if leafy, the leaves are arranged in two rows on opposite sides of the stem and in the same plane, giving the plant a flattened appearance unlike the great majority of mosses. In fruit the capsule opens by four valves instead of a lid as in the mosses.

The terms used in describing mosses are fully defined and illustrated in the glossary, and the student should make himself familiar with the principal terms as early in his study of the mosses as practicable.

The beginner in the study of mosses should be content with the study of well developed fruiting specimens. Imperfect or non-fruiting mosses often prove an insoluble puzzle to the advanced student and would be nothing but a source of discouragement to the beginner. Many mosses of the more difficult genera like Hypnum and Bryum are not included in this book because they cannot be recognized with any degree of certainty without the aid of the compound microscope. As some of these difficult species are common they will prove a source of annoyance to the beginner, and it is hoped will lead him to obtain, sooner or later, the necessary books and apparatus for a more extended study.

Almost any form of simple microscope will serve for the study of mosses with this book, but to obtain the best results it should be of a construction suitable for carrying in the pocket into the field. It is also very desirable that the student have a lens that can be used on a stand as a dissecting microscope. Lenses are easily obtainable that can be used both as a pocket and as a dissecting microscope. The lens should be ten to fifteen diameters magnifying power and with as large a field as one can afford.

In studying very minute parts it will often be of advantage to remove them with forceps and mount in a drop of water between two thin strips of glass or mica, the method used with the compound microscope.

Much more definite data are needed with reference to the habitats and time of maturing spores of even our common mosses. The author has intended to give these as fully as the existing data would permit. In using this book as a guide to the best seasons for collecting any given species, it must be borne in mind that the seasons are a month or so earlier in southern New York and New Jersey than in northern New England and Canada. In the former locality the earliest date given is the best; in the latter locality, the latest.

The following literature on mosses will be very helpful to those desiring a more complete equipment for bryological study:

Mrs. Britton's Observer articles, the files of *The Bryologist*, the author's Vermont Mosses, Barnes and Heald's Keys to the Genera and Species of North American Mosses; the various monographs by Mrs. Britton, Dr. Best, Prof. Barnes, Cheney, and Grout; Lesquereux and James' Manual, and Dixon and Jameson's Hand-Book of the British Mosses. Later on the bryological enthusiast will want more costly and extensive works in English and in foreign languages.

In the pronunciation of the scientific names it is well to remember that the best authorities give the English pronunciation of the Latin with the accent according to the rules of Latin grammar. The Roman pronunciation so much in vogue in schools and colleges is sure at some early date to supersede the English, but at present the English has the weight of authority.

The pronunciation is indicated by the same signs as in the recent works on the flowering plants.

\ Indicates the accent and the long, broad, open, or close English sound of the vowel.

/ Indicates the accent and the short English sound.

KEY NO. 1

Based Mainly on Structural Characters.

Gray to gray-green; growing only in bogs and swamps, ... Peat Mosses.
Not gray (except White Moss); growing in various situations, 2.

2. Acrocarpous, ... A.
   Pleurocarpous, ... B.

A

1. Capsules square in cross-section; calyptra hairy, ... Polytrichum.
   Capsules rounded in cross-section; calyptra various, . 2.
2. Blackish, or brownish-green; growing on bark of living trees, ... 3.
   Green (except Hedwigia); not growing on trees, . . 4.
3. Capsule long exserted, not wrinkled when dry, ... Drummondia.
   Capsule barely exserted; strongly wrinkled, or puckered about the mouth when dry, ... Weissia.
4. Capsules sessile; seta lacking, ... 5.
   Capsules exserted; seta evident, ... 6.
5. Capsules green, nearly spherical; plants of sandy fields, ... Pleuridium.
   Capsules ventricose; plants growing on shaded banks, ... Webera.
   Capsules subspherical, somewhat urn-shaped when dry and empty; plants blackish-green, growing on rocks, ... Hedwigia.
6. Capsules erect, urn-shaped, ... Physcomitrium.
   Capsules erect, greatly swollen at base, . . Splachnum.
   Capsules strongly ventricose; mature plant without leaves, ... Buxbaumia.
   Capsules erect, cylindric, nearly or quite straight, . 7.
   Capsules arcuate, unsymmetric, usually cernuous, . 10.
   Capsules symmetric, cernuous or pendent; ovoid, pyriform, or subglobose, . Mnium, Bryum, and Letobryum.
7. Plants growing on rotten wood, rarely on moist peaty soil, ... Georgia, Dicranum flagellare.
   Plants not growing on rotten wood, ... 8.
8. Plants with hairy calyptra and appearance of the Haircap Mosses, ... Pogonatum.
   Without hairy calyptra, ... 9.
9. Growing in moist shady places, ... Catharinea.
   Growing in dry exposed places, ... Dicranum, Dicranella heteromalla orthocarpa.
   Growing on boulders, ... Dicranum fulvum.
10. Greenish-white, ... Leucobryum.
    Dark to light green, not white, ... 11.

11. Leaves two-ranked; plants appearing flattened, ... Fissidens.
Leaves not two ranked, arising from all sides of the stem, ... 12.

12. Capsules smooth when dry, ... 13.
Capsules furrowed or wrinkled when dry, ... 14.

13. Capsules with a long slender neck, . . Trematodon.
Capsules with neck short or wanting, ... Bryum, Dicranum, Pogonatum alpinum.

14. Capsules subglobose when wet, . Philonotis and Bartramia.
Capsules elongated, often subcylindric, ... 15.

15. Growing on rotten wood, ... Dicranum.
Growing on earth or bases of trees, ... 16.

16. Growing in swamps or very wet places, . Gymnocybe.
Growing in barren places, roadsides, paths, etc., ... Ceratodon, Funaria, and Ditrichum.
Growing in woods on soil, base of trees, or rocks, ... Dicranella.

B

1. Growing on stones in running water, ... Rhynchostegium, Fontinalis, Hypnum, Brachythecium.
Not growing in running water, ... 2.

2. Leaves apparently two-ranked; plants appearing flattened, ... 3.
Leaves not two-ranked, ... 4.

3. Growing on decayed wood, ... Plagiothecium, Raphidostegium, Entodon.
Growing on trees, ... Neckera.
Growing on stones or soil in moist shady places, ... Plagiothecium, Fissidens.

4. Plants regularly once or twice pinnate, looking like miniature ferns, ... Thuidium, Hypnum, Hylocomium proliferum.
Plants not regularly pinnate, ... 5.

5. Capsules erect, straight, ... 6.
Capsules cernuous, curved, ... 11.

6. Growing on bark of trees, ... 7.
Growing on soil or decayed wood, ... 10.

7. Growing only near the base of trees, ... 8.
Growing at various heights on tree trunks, seldom near the base, ... 9.

8. Light green; branches julaceous, ... Thelia.
Dark green; branches somewhat flattened or at least not julaceous, ... Anomodon.

9. Small; seta many times as long as the perichætial leaves, ... Pylaisiella.
Larger; seta not more than twice as long as the perichætial leaves, ... Leucodon.

10. Tree-like, growing on the ground in swamps, . Climacium.
Prostrate in mats on soil and decayed wood, ... Brachythecium acuminatum, Entodon.

11. Operculum with a very long beak, ...
Operculum without beak, . Cirriphyllum, Eurhynchium. . . . . Hylocomium, Hypnum, Brachythecium.

KEY NO. 2

Based Mainly on Habitat

Mosses growing on the bark of living trees, ... A.
Mosses growing on rotten wood, ... B.
Mosses growing on stones but not in water, ... C.
Mosses growing on stones in water, ... D.
Mosses growing on soil, ... E.
Mosses growing on decaying animal tissue or excreta, ... Splachnum.
Mosses growing in swamps and bogs, greenish-white, ... Peat Mosses.

A

1. Seta many times longer than the perichætial leaves, . 3.
Seta shorter than the perichætial leaves, or at most not more than twice as long, ... 2.

2. Acrocarpous; capsules wrinkled or puckered about the mouth, ... Weissia.
Pleurocarpous; capsules smooth, . Leucodon, Neckera.

3. Blackish-green, ... Drummondia.
Dark to light green, ... 4.

4. Capsules cernuous or curved; plants pinnate, . Thuidium.
Capsules erect, straight, ... 5.

5. Dark green, growing only around the base of trees, ... Anomodon.
Light green, usually growing near the base of trees, ... Thelia.
Dark to yellowish-green, usually growing higher up on trees, ... Pylaisiella.

B

1. Capsules erect, cylindric and nearly symmetric, . . . 2.
Capsules curved, horizontal or pendent, ... 4.

2. Pleurocarpous, . Brachythecium acuminatum, Entodon.
Acrocarpous, ... 3.

3. Peristome of four large teeth, ... Georgia.
Peristome of numerous smaller teeth, ... Dicranum flagellare.

4. Capsules ovoid to subglobose, horizontal to pendent, ... Mnium.
Capsules subcylindric, arcuate, ... 5.

5. Acrocarpous, ... Dicranum.
Pleurocarpous, ...
Brachythecium, Raphidostegium, Hylocomium, Hypnum, Plagiothecium.

C

1. Blackish-green to brownish-green, ... 2.
Green. . . . . 3.
2. Capsules exserted, ... Weissia Americana.
Capsules immersed, ... Hedwigia.
3. Flattened; leaves two-ranked, ... Fissidens.
Leaves spreading in all directions, ... 4.
4. Capsules ovoid to oblong, unsymmetric, . Brachythecium.
Capsules subcylindric, not furrowed when dry, ... Dicranum.
Capsules subglobose, deeply furrowed when dry, ... Bartramia, Philonotis.

D

1. Long, slender, and floating, ... Fontinalis.
Short, not more than one or two inches in length, . 2.
2. Leaves ovate; operculum long beaked, . Rhynchostegium.
Leaves ovate; operculum conic, . . Brachythecium.
Leaves orbicular, operculum conic, . Hypnum dilatatum.

E

In wet shaded places, ...
Catharinea, Fissidens, Gymnocybe, Mnium, Hypnum, Plagiothecium, Climacium.

In moist shaded places, ...
Catharinea, Hypnum, Thuidium, Hylocomium, Eurhynchium, Plagiothecium, Brachythecium, Webera, Pogonatum, Leucobryum.

In dry open places with grass, ...
Polytrichum, Cirriphyllum, Pleuridium, Thuidium.

In dry waste places, old paths, old ploughed fields, etc., .
Pogonatum, Ditrichum, Trematodon, Ceratodon, Funaria, Physcomitrium, Bryum.

In various situations, ...
Dicranum, Dicranella, Leptobryum, Thuidium, Hylocomium, Buxbaumia, Leucobryum, Bryum.

ACKNOWLEDGEMENTS

I wish to acknowledge my great obligation to Miss Mary V. Thayer for her careful and artistic work in the preparation of the drawings. By an oversight, Miss Thayer's initials were omitted from a few of the cuts. She made all the drawings to illustrate the text. I am also greatly indebted to Mr. Paul R. Jenks, and to Dr. Marshall A. Howe of Columbia University, for reading the proof and for assistance in determining the pronunciation of the scientific names.

TABLE OF CONTENTS

Introduction, ... iv.
Keys, ... vi.
Acknowledgements, ... x.
Text, ... 1.
Numbered List, ... 56.
Errata, ... 59
Glossary, ... 60.
Index, ... 74.

EXPLANATION OF PLATE I.—a, *Sphágnum squarròsum* Pers. Fig. b, *S. acutifòlium* Ehrh. Fig. c, *S. cymbifòlium* (Ehrh.) Hedw. d, Capsules.

THE PEAT MOSSES

THE Peat Mosses (Plate I.) are so different from the other mosses that many authors favor putting them in a separate class. Their protonema is much like the prothallium of the ferns, and the stalk on which the capsule is borne is in no way homologous with the seta of other mosses. The structure of the leaves is also very different from that of the other mosses.

Economically, the Peat Mosses are of more value than any others. In many portions of Ireland and Scotland peat is almost the only fuel supply of the peasantry. In the United States there is an abundant supply of peat. Dana estimates that there are 15,000,000,000 cubic feet in Massachusetts alone. Cheaper and more satisfactory fuels are so abundant that peat is little used in this country.

Peat Mosses grow in and near water in swamps. They keep growing at the top and dying below. Sticks, leaves and other vegetable matter is washed in among the decaying stems. The whole mass, being saturated with water, decays slowly, leaving a black substance whose combustibility depends upon the purity of the carbon. The "muck" of the farmers is an incomplete or an impure peat.

Peat Mosses grow into small ponds from the margin and frequently fill them entirely, forming quaking bogs. In other instances there is a small black pool in the center of the bog, all that remains of a much larger body of water that once occupied the whole area now occupied by the bog.

These bogs are very treacherous, and men and animals not infrequently perish through being engulfed in the black slimy mud. There is some antiseptic property in this mud which preserves animal and vegetable tissue for a long time. Huge logs are often dug out of these swamps in a condition fit for excellent lumber. In Ireland the body of a woman dressed in haircloth was unearthed from under eleven feet of peat, where it must have lain for centuries.

Peat Mosses absorb water very freely and serve to hold back the water that falls during heavy storms, preventing floods, and retaining the water until it is more needed. Because of this absorbent power these mosses are much used by florists for packing flowers.

These mosses are easily recognized by their light gray-green color (sometimes pink or red at the top) and their peculiar shape, which is well illustrated in the figures.

The Peat Mosses of Europe and America are the same in the main. There are, according to recent continental authors, a great number of species, which it requires all the trained ability of an expert to recognize. But for our purposes there are two easily recognized groups, each of which contains many so-called species.

The Spoon-leaved Peat Mosses, fig. c, c', c", are easily recognized by their thick branches and their broad spoon-shaped leaves. The Acute-leaved Peat Mosses are figured in a, á and b, b. Fig. b represents the Acute-leaved Peat Moss, which is common in all the peat bogs of Europe and America. It is often tinged at the top with a bright red or crimson color. The Squarrose Peat Moss is one of the Acute-leaved group, but is easily distinguished by the spreading tips of the leaves, as indicated in fig. a, á. The branches are much stouter than in the Acute-leaved Peat Moss proper.

BUXBAUMIA*

THE drawings speak for themselves. No one who finds the queer looking objects figured here will have any difficulty in identifying them.

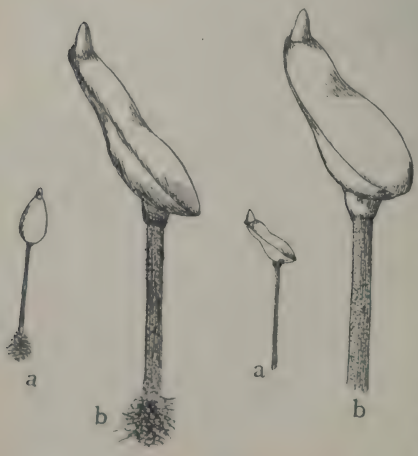


Fig. 1. a, a, two different views of *Buxbaumia aphylla* × 1; b, b, two different views × 4.

Buxbaumia is more highly modified than almost any other moss. Its leaves are few and are clustered at the base of the seta. They entirely disappear before the capsule ripens, so that the mature plant consists of only the seta with a few rhizoids at the base and the queer, bug-like capsule. Mrs. Britton calls the Buxbaumias "The Hump-backed Elves." To the author they look like bugs on a stick.

The capsules are in the best condition late in autumn or early winter.

WEBERA†

MUCH more common than Buxbaumia and scarcely less interesting, is the odd little Webera shown in figure 2. The capsules have much the same one-sided tilt, but are less irregular in outline and are partially incased in the fringed perichætial leaves. The capsule is almost sessile, the seta being so short as to be scarcely apparent. The leaves are persistent and the non-fruiting plants are frequently so abundant as to make a broad mat of dark green, dotted here and there with the lighter colored capsules. In looking for Webera search for a moist bank where there is little or no tall vegetation, and which at a little distance appears dark green mottled with white. (The white is a lichen that is nearly always found with the Webera). Webera is so common and so easily recognized that every lover of mosses should be able to collect it in his home locality. The capsules persist for a long time, but July is a good time to collect this species.

Fig. 2. a, *Webera sessilis* ×4. b, Leaves ×4. c, Perichætial leaves ×4. d and e, Peristome and operculum ×10.

†We have but one species of Webera, *W. sessilis* (Schmid.) Lindb.—*Diphyscium foliosum of many authors.*

*The species figured is *Buxbaumia aphylla* L. The only other Eastern species is *B. indusiata* Brid. The two are very much alike, but are separated by Mrs. Britton, thus:

On earth; capsule red-brown, shining . . . . . *B aphylla.*
On wood; capsule green or yellow, dull . . . . . *B. indusiata*

GEÓRGIA*

THE botanists of preceding centuries were often under royal patronage and frequently found it convenient to pay their respects to kings and queens. Thus Georgia is named for King George III. of England, and Catharinea for Empress Catharine II. of Russia.

Fig. 3. a, *Georgia pellùcida* × 12. b, Gemmiferous branch × 2. Capsule × 10. c, Peristome × 20.

Georgia is very abundant on decayed stumps in moist woods. On the western end of Long Island where decayed wood is scarce, it grows luxuriantly on the banks of brooks in swamps, the black peaty soil being as rich in organic matter as decaying wood.

The Flagellate Dicranum (*Plate 4,c*), which in New England grows almost exclusively on decayed wood, on Long Island has a habitat similar to that of Georgia. This goes to prove that some mosses growing on decayed wood are true saprophytes, although their saprophytism has not gone so far as to enable the plants to dispense with chlorophyll.

Georgia has two characteristics that will serve to make its identification easy. Its peristome consists of four long teeth that are readily distinguishable under the lens. It is the only moss with this number of teeth in the peristome (except a very rare species known from only four localities in the United States, and so small as to be difficult of observation). The other character is the possession of slender branches bearing cup-like clusters of leaves. In this cluster of leaves are minute green bodies, gemmæ, which fall off and give rise to new plants in the same way that the bulblets of Cystopteris give rise to that fern.

Georgia fruits very abundantly and the capsules persist for a year or two, so that there is no difficulty in finding or identifying it. The capsules are in the best condition late in autumn.

**Georgia pellùcida* (L.) Rabenh. *Tetraphis pellucida* of many authors.

EXPLANATION OF PLATE II.—a, Fruiting *Polytrichum commune* × 1, dry. b, The same moist with the calyptra removed. c, Leaf of the same × 10. d, Capsule of the same × 5. e, Capsule of *P. Ohioense* × 5. f, Male plant of *P. commune* × 1. g and h, *P. piliferum*, dry and wet, × 1. o, Leaf of *P. juniperinum* × 10. ó, Portion of the same × 30. p, Leaf of *P. piliferum* × 10.

THE HAIR-CAP MOSSES

THE Hair-Cap Mosses, called Bird Wheat in many localities, are the largest and most highly developed of all our mosses, and by reason of their size and common occurrence are familiar objects to nearly every one. Many an old field and meadow is carpeted with the dark rich green of the Common Hair-cap. The farmer, however, votes it a pest, as it often entirely supplants the grass over large areas of meadow.

The hairy cap that gives this genus of mosses its name is composed of long hairs growing from a little scale-like body, the calyptra proper, at the top of the capsule.

The Hair-caps, in common with most other mosses, are subject to great extremes of moisture and dryness, and their appearance when dry is very different from what it is when moist, as the leaves fold up against the stem to check the rapidity of evaporation. Some plants that do not produce a sporophyte end in a rosette of highly modified leaves. These are the male plants, and among the leaves of the rosette are numerous antheridia. The male plants of many other dioicous mosses end in a similar rosette.

There are four common species of the Hair-caps, all having square capsules. The Pogonatums are put with the Hair-caps by some authors, but are readily distinguished by the cylindric capsules. In other respects there is very little to distinguish the two genera.

The Common Hair-cap is our largest moss, sometimes having stems a foot long, although usually much smaller. It is one of of the most widely distributed of plants, being found in all parts of North America, in Europe and in Asia. It is also one of the very few mosses put to some economic use. The Laplanders use it to stuff pillows and beds. In England it is sometimes used for brooms.

The leaves of the Common Hair-cap are very thick and strong, with a thinner clasping base and serrate margins. The capsules mature in June or early July.

The Ohio Hair-cap without the sporophyte (seta and capsule, commonly called fruit) is not readily distinguished from the Common, as the leaves and general appearance are very similar. But with the sporophyte present, the distinctions are clear. In figs. b and d, note that the capsule of the Common Hair-cap is almost cubical, that the lid has a very short beak, and that the capsule is entirely covered by the calyptra. The capsule of the Ohio Hair-cap (e) is

elongated, slender with a tapering neck, and with a much longer beak to the lid. The lid and the calyptra of the Ohio Hair-cap fall early in June, very soon after the spores are ripe, and it is not always easy to find either in position, but if the calyptra be found, it will be seen to cover the upper portion of the capsule only. The Common Hair-cap, although occurring in woods, is most common in open fields; the Ohio Hair-cap being most frequent in shady, more moist spots, often in deep woods. The remaining two species are easily distinguished from the two mentioned above by the margins of the leaves, which are thin and membranaceous, and are folded in over the central portion of the leaf, as illustrated in o, ó, and p.

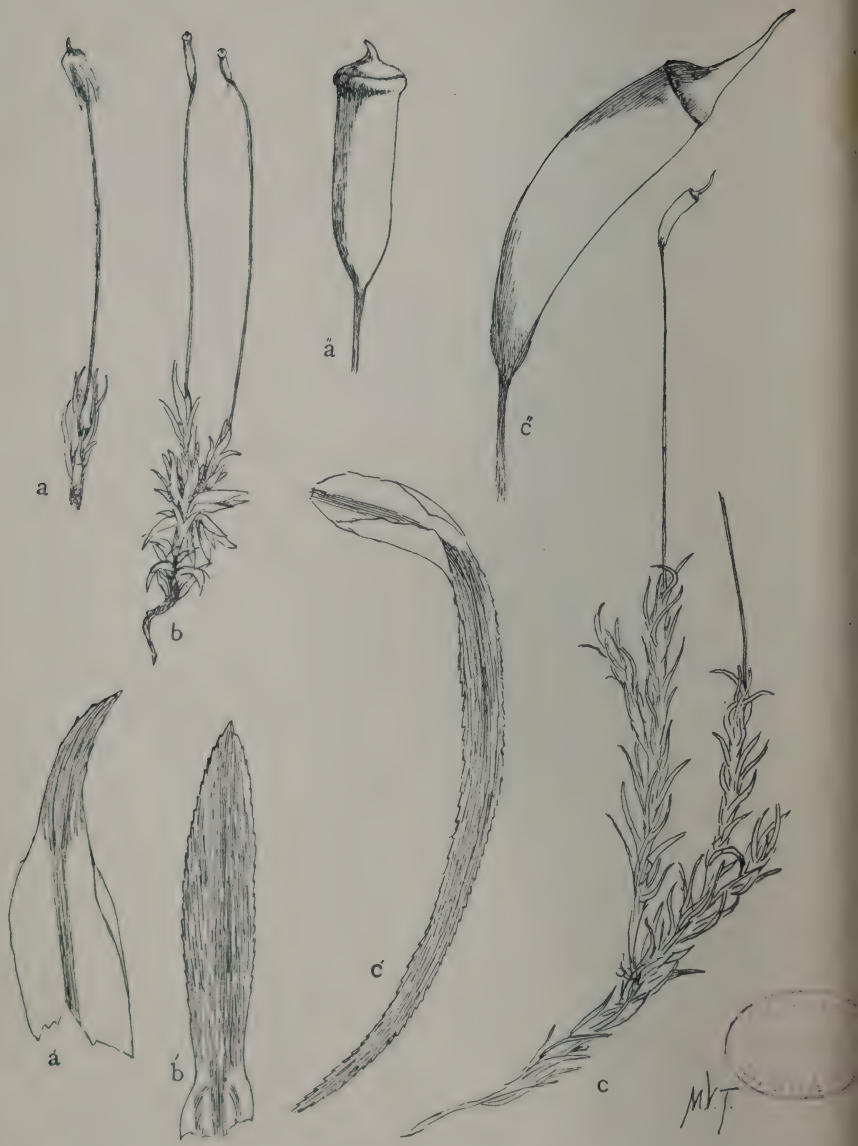
The Juniper Hair-cap resembles the Common very closely in general appearance and is commonly confused with it, as it grows in similar but usually drier situations. It is, however, lighter in color, and a glance at the upper surface of the leaves under a lens will serve to distinguish it without the shadow of a doubt. Its capsules mature about the same time as those of the Common Hair-cap, or slightly earlier.

The Awned Hair-cap also has its leaves turned in at the margin, but they differ in shape, as shown in the figure, and end in long white awns. The entire plant is much smaller than any of the other species, and grows in much drier places, the edges of soil around ledges in rocky pastures being a favorite habitat. It matures its capsules in June and July. I have found the Awned Hair-cap on ledges next the bare rock, the Juniper Hair-cap a little farther down but bordering on the Awned, and the Common Hair-cap growing in moist depressions in the ledge partially filled with soil.

Those who climb mountains will be sure to find a fifth species, the Erect Hair-cap, which is very common in boggy places at an elevation of 3,000 feet or more. It is closely related to the Juniper Hair-cap, but can readily be distinguished by the more slender, densely radiculose stems and the much smaller capsules.

KEY.

Leaf margins serrate, not infolded, ... 2.
Leaf margins entire, thin and infolded, ... 3.
2. Capsules cubical, beak short, Common Hair-cap, ... (*Polytrichum commune* L.).
Capsule much longer than broad, beak long, neck tapering, ... Ohio Hair-cap (*P. Ohioénse* R. & C.)



EXPLANATION OF PLATE III.—a, *Pogonatum tenue* × 2. a′, Leaf × 15. a″, Capsule × 10. b, *P. urnigerum* × 2. b′, Leaf × 10. c, *P. alpinum* × 2. c′, Leaf × 10. c″, Capsule × 10

3. Plants of dry situations, small, leaves with long white awns, ... Awned Hair-cap (*P. piliferum* Schreb.)
   Plants larger, leaves without white awns, ... 4.
4. Plants of lowlands without felted radicles, ... Juniper Hair-cap, (*P. junipérinum* Willd.).
   Plants of alpine or subalpine regions; stems covered with a dense felt of radicles, Erect Hair-cap (*P. strictum* Banks).

THE POGONÀTUMS

THE Pogonatums differ from the Hair-caps mainly in the cylindrical capsules, not square or angular in section.

The Slender Pogonatum is probably the most common of our species. It grows on bare moist banks of clay or loam where other plants have not yet obtained a foothold. The plants do not grow close together as with most mosses, but singly and scattered, the soil between them being covered with green felt-like protonema. All mosses grow from just such green felt; the spore germinates and grows into the protonema and a branch of the protonema develops into the moss plant. After the moss plant proper has developed, the protonema usually disappears. In the Slender Pogonatum, however, the protonema is persistent and plays an active part in the nutrition of the plant, seeming to perform the function of leaves, for the leaves on this plant are very few and short as compared with the allied species. This is well illustrated by the figures, the dark shaded upper portion of the leaf being the only part that contains chlorophyll and therefore the only portion that performs the functions of a leaf. These marked and interesting modifications may be due to the fact that this moss grows on freshly disturbed earth and by this method is enabled to fruit before its competitors for the space are able to develop. The capsules mature in late autumn.

In woods and shady places, especially in elevated regions, the Alpine Pogonatum is common. It is at once recognized by its larger size and longer curved capsule with long beaked operculum. The leaves, also, are much longer and more slender. Without the sporophyte the Alpine Pogonatum is most likely to be mistaken for some of the Hair-caps. Its capsules mature in June or early July.

The Urn-like Pogonatum grows in woods and shady places, preferring elevated regions. It is not uncommon and in some localities may be even more common than either of the species

mentioned above. I, however, have met with it much less frequently. It is at once distinguished from the Alpine Pogonatum by its straight erect capsule, which is scarcely to be distinguished from that of the Slender Pogonatum. It is usually smaller than the Alpine Pogonatum and much larger than the Slender Pogonatum, but is so variable that this is not to be depended upon. Its leaves, however, will serve to distinguish it readily from the Slender Pogonatum when its size is deceptive. The capsules mature in autumn.

Those who climb mountains will find on all alpine heights a fourth species, the Hair-like Pogonatum. It has broad leaves like those of the Urn-like Pogonatum, but they are much more strongly curved when dry. It is also much smaller, with simple unbranched stems and shorter capsules.

KEY.

1. Capsule curved, long-beaked, Alpine Pogonatum, ... [*Pogonatum alpinum* (L.) Roehl.]
   Capsule erect, straight, short-beaked, ... 2.
2. Plants small, unbranched, ... 3.
   Plants larger, branched and variously divided, ... Urn like Pogonatum [*P. urnigerum* (L.) Beauv.]
3. Alpine, growing close together; leaves numerous, ... Hair-like Pogonatum [*P. capillare* (Mx.) Brid.]
   Plants of lowlands, growing scattered; leaves few, ... Slender Pogonatum [*P. tenue* (Menzies) E. G. Britton.]

THE CATHARINEAS

THE Catharineas are very closely related to the Hair-caps, but have the calyptra nearly bald. It is merely roughened with a few vestigial hairs.

The Wavy Catharinea is one of the very common mosses, occurring everywhere in eastern North America. It grows best on moist shady banks of brooks. It can be easily recognized by its long, slender, slightly curved capsules and leaves strongly crisped when dry.

The Narrow-leaved Catharinea resembles the Wavy Catharinea very closely, but grows in dryer, more sandy soil, and is usually much smaller with narrower straighter capsules, as shown in the cut. The only sure way to distinguish them is to mount the leaves in water and study with the lens. The differences are

Fig. 4. a, a, a, *Catharinea undulata*, wet and dry, ×2, and Capsule × 5. b, Leaf × 10. c, c, Capsule and leaf of *C. angustata* × 5 and 10, respectively.

shown in the cut. Although the leaf of the Narrow-leaved Catharinea is narrower, the midrib is much broader, constituting one-third to one-quarter the breadth of the leaf.

The sporophyte of the Catharineas is in good condition from late autumn to early spring.

In swampy places by brooks along the south shore of Long Island, and probably along the coast of New Jersey, Connecticut, and Rhode Island, the Crisped Catharinea is not infrequent. Its leaves are twice as broad in proportion to their length as those of the Wavy Catharinea, and are not at all wavy when moist. The capsule is very much shorter than in either of the other species

KEY.

1. Capsule 4 : 1 ; leaves not at all wavy on the margins when moist, Crisped Catharínea, ... (*Catharinea crispa* James).
   Capsule 6–8 : 1 ; leaf margins wavy when moist, . . . 2.
2. Midrib constituting $\frac{1}{8}$-$\frac{1}{10}$ of leaf, Wavy Catharinea. . . . . [*C. undulàta* (L.) Web. & Mohr.]
   Midrib constituting $\frac{1}{3}$-$\frac{1}{4}$ of leaf, Narrow-leaved Catharinea, ... (*C. angustàta* Brid.).

FISSIDENS

THE genus Fissidens is most distinct and easily recognized, but to recognize the species with certainty requires a compound microscope and considerable experience in the study of the genus.

Fig. 5. 1. Fruiting *Fissidens cristàtus* (Wils.) 2. Capsule with calyptra removed. 3. Leaf and portion of stem to which it is attached. 4. Leaves, showing how they overlap each other and sheath the stem.

The leaves of Fissidens are in two ranks on opposite sides of the stem, and as both ranks lie in the same plane, it gives the plants a peculiar appearance not possessed by any other moss and reminding one strongly of the Hepatics. The leaves of Fissidens have a very peculiar structure, the exact meaning of which is still a puzzle. If a small plant be mounted in water between two glass slips and examined with the lens, the basal portion of the upper margin will be seen to be considerably darker than the rest of the leaf, as is

shown in Figs. 1, and 3, *a*. This darker portion of the leaf is double, being composed of two entirely separate layers. A cross section through this portion of the leaf would have the shape of a simple y, the two arms of the y being the section through this double portion.

A few rare species of Fissidens grow in water, but most grow on moist soil or rocks. Several species are so common that they can be found in any locality.

THE WHITE MOSS

ANY ONE accustomed to walk in the woods must have noticed the grayish-white tufts of the White Moss, looking like gigantic pincushions.

FIG. 6. *Leucobryum glaucum* × 1.

This moss does not fruit freely, but by searching in moist woods the sporophyte can usually be found without a great deal of trouble. It matures from September to June.

The White Moss prefers moist or even swampy woods, but is often found in drier situations. The plants grow densely packed together, those in the center continually elongating and new plants being added around the edges of the tuft. The White Moss resembles the Peat Mosses in color, and the cushion-like tufts take up and retain water in the same sponge-like way.

The common species of the White Moss is *Leucobryum glaucum* (L.) Sch. (*L. vulgare* Hampe).

THE DICRANUMS

THE Dicranums of our region are one of the most common and beautiful elements in woodland scenery. They are, for the most part, bright yellow-green and grow in wide thick tufts or mats. The leaves are frequently more or less secund, as though the wind had blown them all in one direction.

Most Dicranums mature their spores in autumn, but more observations are needed to give dates for each species.

Fig. 7. a, *Dicranum scopàrium* × 1. á, Capsule × 5. b, *D. fuscescens* × 1. b'. Capsule and calyptra × 5.

There are eighteen or twenty species of Dicranum within our range, but of these only six are common or easy enough of recognition to warrant treatment here. These six are best treated in three groups. The first group contains two species with single curved capsules, the Broom Moss (*Dicranum scopárium* (L.) Hedw.) and the Fuscous Dicranum (*D. fuscescens* Turn.)

The second group contains two species with clustered curved capsules, the Wavy Dicranum (*D. undulàtum* Ehrh.) and Drummond's Dicranum (*D. Drummóndii* C. Muell.)

The third group, two species with single erect straight capsules, the Flagellate Dicranum (*D. flagellàre* Hedw.), and the Fulvous Dicranum (*D. fúlvum* Hook.) The capsules of the former are often as erect and straight as those of the latter, although not so represented in the plate.

The distinctions between the Broom Moss and the Fuscous Dicranum are well brought out in the figures. The Broom Moss grows on decayed wood, but more frequently on soil, stones, and roots of trees. The plants are larger, with leaves secund but not crisped when dry; capsules longer, more slender and not furrowed when dry. The Fuscous Dicranum grows on rotten wood; the plants are smaller and finer, with leaves crisped when dry; the capsules shorter and furrowed when dry. The Broom Moss gets its name from its resemblance in miniature to a hair broom or counter brush. It is often used by florists to form banks of green in show windows. It is much more common than the Fuscous Dicranum and is found everywhere throughout our range.

The Wavy Dicranum is the largest and most beautiful of our species, and while common, does not fruit freely in most localities. It grows on the ground and rocks in woods; its leaves are secund but have a beautiful silky gloss, due in part to their being

EXPLANATION OF PLATE IV.—a, *Dicranum undulatum* × 1. a', Leaf × 8. b, *D. Drummondii* × 1. b', Leaf × 8. c, *D. flagellare* × 2. c', Leaf × 10. d, *Flagella* × 10. e, *D. fulvum* × 2. e', Leaf and capsule × 10.

very strongly wavy. Drummond's Dicranum grows on rotten wood; its leaves are somewhat secund and are very strongly crisped when dry, also very slightly wavy; they are much more slender pointed than in the Wavy Dicranum. The capsules of the two species are very much alike.

The Flagellate and Fulvous Dicranums need never be confused, for the former grows on rotten wood or peaty banks, while the latter always grows on rocks. The Flagellate Dicranum has slender branchlets (flagella), with minute leaves, which give it its name. The Fulvous Dicranum lacks these flagella and is usually somewhat brownish-fulvous in color. Its leaves are much longer, with a very broad thick midrib. The differences in the leaves are best seen by mounting them as for the compound microscope.

DICRANÉLLA

THE Common Dicranella [*D. heteromálla* (L.) Schimp.] looks like a little Dicranum, as its name would imply. It is frequent on moist shady banks in regions somewhat removed from the coast. Near the coast, particularly in the southern portion of our range, the variety with straight capsules (var. *orthocàrpa* Hedw.) is common in rather dry sandy soil. The species is rather taller with the capsules somewhat longer and more oblique, and slightly furrowed when dry. Both forms mature the capsules in autumn.

Fig. 8. *Dicranella heteromalla orthocarpa* × 4. b, Capsule of the same × 10. c, Dry capsules of *D. heteromalla*.

CERÁTODON

CERATODON is one of the commonest of all our mosses. It is found on the edges of paths, roofs of old buildings, sand by the sea shore, and in general any barren compact soil is its favorite habitat. The plants are short and grow close together, forming dense thin mats of dark green. The lance-like young sporophytes appear early in spring as soon as the snow is melted. By the middle of the summer the capsules often decay beyond recognition and the seta breaks from the plant at the touch.

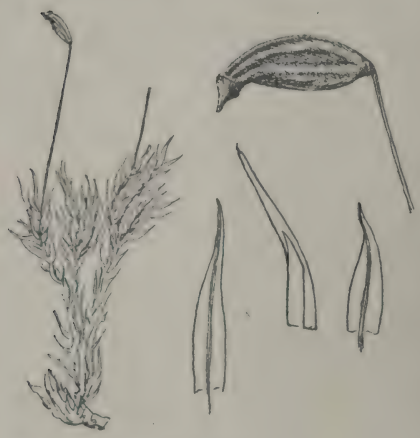


Fig. 9 *Ceratodon purpureus* × 2. Leaves, calyptra, and capsule × 10.

Unless one has become very familiar with Ceratodon it is not always easy to recognize it without mature capsules. When the capsules have fully matured they shrink when dry and become furrowed. This peculiar furrowing and the dark rich color of the capsules, a color called purple by the older botanists but which is really a very dark chestnut or red-brown, make it easy to recognize this species [*Ceratodon purpureus* (L.) Brid.]

Gymnocybe has a capsule furrowed in a similar manner, but it is easily distinguished by the characters noted under the description of that genus.

THE DITRICHUMS*

THE Dark Ditrichum [*D. vaginans* (Sulliv.) Hampe] has a habitat very similar to that of Ceratodon and at first sight might be confused with it. The capsules are much the same color and somewhat furrowed, but it is smaller with more

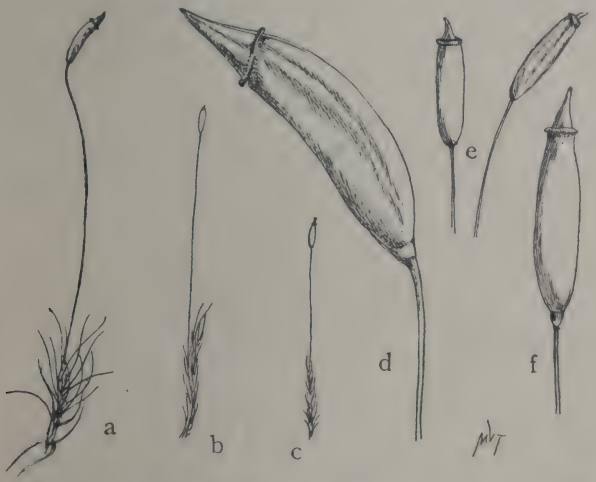


Fig. 10. a, b, and c, *Ditrichum pallidum*, *vaginans* and *tortile*, repectively, × 2. d, Capsule of *D. pallidum* × 20. e, Capsules of *D. vaginans* × 10. f, Capsule of *D. tortile* × 20.

erect symmetric capsules that have much less conspicuous furrows when dry. It matures its spores late in autumn, which of itself will be sufficient readily to distinguish it from Ceratodon. It is not frequent in the more nothern portion of our range

The Brown Ditrichum [*D. tortile* (Schrad.) Hampe] is frequent throughout in moist sandy or gravelly soil by roadsides and in old fields. It is closely related to the Dark Ditrichum, but is smaller, with light brown capsules which mature at about the same time and are smooth when dry.

The Yellow Ditrichum [*D. pallidum* (Schreb.) Hampe] is more abundant southwards and in the lowlands, and is much larger than the other two species. It is easily recognized by its bright yellow seta and unsymmetric capsules, which mature in winter. It is most frequent in dry sandy soil.

**Ditrichum* Timm.—*Leptotrichum* Hampe.

THE LONG-NECKED MOSS

THE Long-necked Moss is so odd in appearance that it will need little description. It is not common but will be met with occasionally in rather dry soil in copses and old fields where the grass is thin. Besides the long neck, the bright yellow setæ, closely resembling those of the Yellow Ditrichum, are an additional aid in identification. The capsules mature in summer.

Fig. 11. *Trematodon ambiguus* × 1, and capsule × 5.

Besides the Long-necked Moss described above [*Trematodon ambiguus* (Hedw.) Hornsch.] there is another species (*T. longicollis*) that may be found in the southern portion of our range.

PLEURIDIUM

THE COMMON PLEURIDIUM [*P. subulatum* (L.) RABENH.]

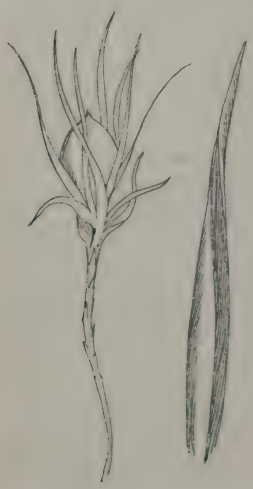


Fig. 12. *Pleuridium subulatum* × 10, and leaf × 20.

DOWN among the tufts of grass in dry and sandy fields in early spring, one can find soft silky tufts of green containing innumerable little green spheres like emerald dew drops. These green spheres are the capsules nestling among the leaves because of the shortness of the setæ.

The drawing can give no idea of the beauty of a dense tuft several inches square, fresh from the fields, wet with the spring snows and rains.

This moss is common in sandy localities near the coast, but much less frequent inland.

There is another similar species that may be met with, but which one will need a compound microscope to distinguish.

THE GRIMMIA FAMILY

THE Grimmias and their allies constitute a large family of mosses characterized by their very dark color, setæ so short that the capsule is often not exserted, and by other characters that are microscopic. They are blackish, or brownish green, sometimes hoary by reason of the colorless leaf apices. They grow almost exclusively on stones and bark of living trees. Some are aquatic, growing on stones in swift brooks, but most grow in dry situations, during a dry period becoming so dry and brittle as to crumble in the fingers, but taking advantage of every rain to start up their growth with renewed energy.

Some of the most common and conspicuous members of this family are *Hedwigia*, *Drummondia*, *Weissia*, *Grimmia*, and *Orthotrichum*. The last two are too difficult to treat here.

DRUMMÓNDIA

Fig. 15. *Drummondia prorepens*. a × 1. b × 10. c, Calyptra × 10. d, Empty capsule × 10.

DRUMMONDIA is a common moss of the Grimmia family. It always grows on the bark of trees, but is easily distinguished from its tree-growing allies by three characters: Its stems are long and closely applied to the bark of the tree, sending out short horizontal branchlets so thickly that the stems below become apparent only when the plant is removed. The capsule is on a long seta, and the calyptra is cucullate.

Drummondia is named for Drummond, one of the earliest collectors of American mosses. Our only species is *D. prorèpens* (Hedw.) E. G. Britton. (*D. clavellata* Hook).

HEDWIGIA

is named for Hedwig, one of the best bryologists of the eighteenth century.

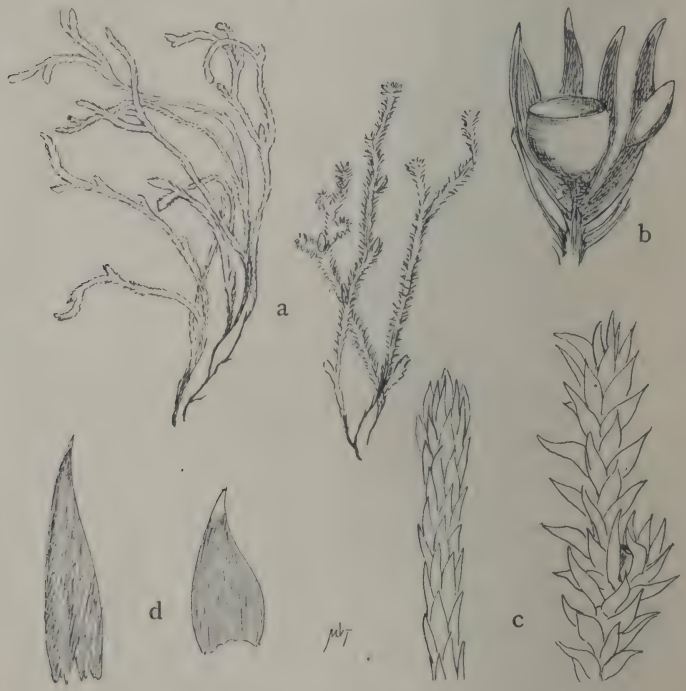


Fig. 14. *Hedwigia albicans*, a, × 1, wet and dry. b, Capsule with a portion of the perichætial leaves removed × 10. c, Branches, dry and wet, × 5. d, Leaves × 10.

It is common on boulders, ledges, stone walls, and dry exposed places. The plants vary a great deal in size, but in general have much longer stems and branches than their relatives, besides being much the most common of all the family.

The lower part of the plant is brown or black, the upper green, with a tinge of gray due to the colorless tips of the leaves. The capsules are entirely concealed in the longer more slender perichætial leaves, and the only indication of their presence is a slight enlargement of the ends of some of the

branches. The capsules are almost spherical, with a clear-cut lid and no peristome; they mature in spring.

An attempt has been made to illustrate the remarkable transformation that these plants undergo when moistened, but no drawing can do justice to the magic of the change.

Our only species is *H. albicans* (Web.) Lindb. (*H. ciliata* Ehrh.)

WEISSIA

THE Weissias have the characteristic brownish-green or blackish-green color of the Grimmia family. They are distinguished from all save Orthotrichum by the hairy calyptra.

Both Orthotrichum and Weissia grow on the bark of trees or more rarely on rocks, in cushions of varying size and thickness. The Weissias growing on trees usually grow in more rounded tufts with the leaves more crisped when dry than is usual with Orthotrichum growing in similar situations. The books all say that the hairs on the calyptra of Weissia are flexuous, and those on Orthotrichum straight, but this distinction appears to be rather too fine for the amateur to profit by it. The capsules in both genera are erect and symmetric and quite regularly striate when dry with eight or sixteen ridges and as many alternating furrows. These ridges consist of cells larger, darker, and thicker-walled than the alternating tissue. The seta in Orthotrichum is so short that the capsule is nearly always partially immersed; in Weissia the seta is long enough to exsert the capsule entirely beyond the perichætial leaves.

Orthotrichum is a very large and difficult genus, and cannot be successfully treated in a book of this kind. Weissia is a small genus whose species are easily recognizable without any lens whatever.

The Puckered Weissia has pear-shaped capsules, abruptly narrowed to the very small mouth; the ridges and furrows extend only a short distance around the mouth of the capsule, giving it the peculiar and characteristic appearance shown in the cut.

The capsules of the Crisped Weissia have a much larger mouth and are striate for the entire length. The seta is shorter, the color is lighter, and the tufts are rather thicker than in the Puckered Weissia. In a not uncommon variety of the Crisped Weissia the capsule is much shorter and is suddenly contracted into a neck,

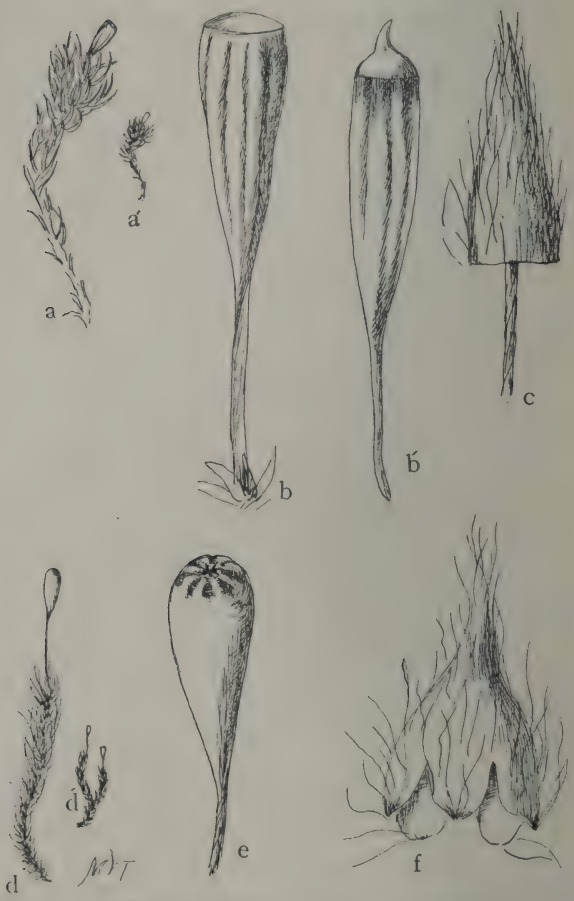


Fig. 15. a, á, *Weissia ulophylla* × 4 and × 1 respectively. b, b', Capsules of the same × 20. c, Young sporophyte with calyptra × 20. d, d', *Weissia coarctata* × 4 and × 1 respectively. e, Capsule × 20. f, Calyptra of mature capsule × 21.

narrow and much twisted when dry. These two species grow exclusively on trees; the third, the American Weissia, grows exclusively on rocks. Its leaves are rigid when dry like those of Orthotrichum, not crisped as in the two tree-growing species; the capsules very closely resemble those of the Crisped Weissia.

All three of the Weissias are common in the hilly regions of our range. They mature their capsules in autumn or early win-

ter, but apart from the calyptra are more characteristic when dry and empty. The tree-growing species furnish good collecting for winter and early spring, when most other mosses are buried under the snow.

WEISSIA EHRH.=Ulota Mohr.

The Puckered Weissia=*W. coarctàta* (Beauv.) Lindb.=*Ulota Ludwigii* Brid.

The Crisped W.=*W. ulophýlla* Ehrh =*Ulota crispa* Brid.

The variety=*W. ulophylla crispula* (Bruch) Hammar =*Ulota crispula* Brid.

The American Weissia=*W. Americàna* (Beauv.) Lindb.=*Ulota Hutchinsiæ* Schimp.

SPLÁCHNUM

THE odd looking moss represented in Fig. 16 is not very common and will not be found readily by most students. It is so striking in appearance that no one can fail to recognize it. The spores are borne in the slender upper portion; the swollen and colored lower portion is the neck of the capsule, which is covered with stomata and filled with loose tissue suitable for the assimilation of carbon dioxide. When dry, this portion becomes irregularly shrunken in a manner very difficult to represent in a drawing.

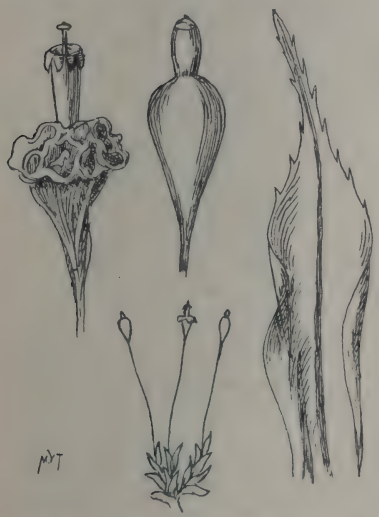


Fig. 16. *Splachnum ampullaceum;* leaf × 10; capsule, ripe and unripe, × 5. (The plant and capsules represented are rather small, as they are often found of twice this size).

There are several species of Splachnum, but the only one likely to be found is *S. ampullàceum* L.

There are several other rare mosses of the Splachnum Family, all remarkable for the swollen neck (much less conspicuous than in Splachnum, however), and for growing on animal excreta or decaying animal tissue.

THE CORD MOSS

THE Cord Moss [*Funària hygrométrica* (L.) Sibth.] is so called because of the twisted seta, which is very hygroscopic and untwists when moist. Its Latin name, Funaria, is derived from *funis*, a rope. This twisting of the seta is not peculiar to this moss, however, but is a very common thing in nearly all moss families.

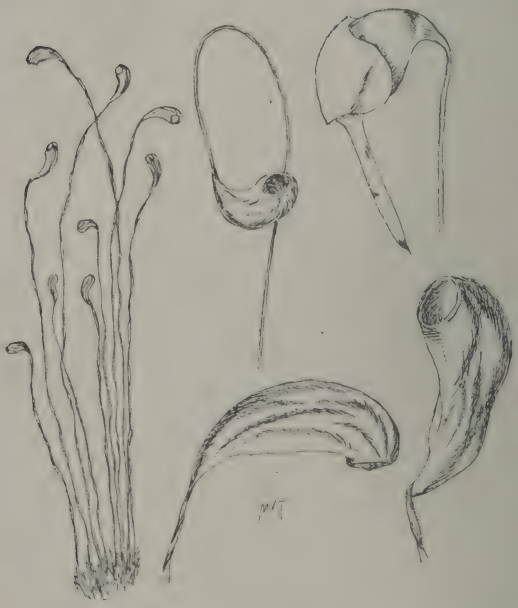


Fig. 17. *Funaria hygrometrica* × 2, with capsules of various ages and degrees of magnification.

The Cord Moss is to be found everywhere, being especially abundant in waste places and on soil recently burned over. I have seen it completely cover the soil in an old strawberry bed. When mature it is easily recognized by the peculiar looking curved capsule with its mouth on one side. When immature it is much harder to recognize, because the capsule is erect and nearly symmetric and the calyptra has not assumed the characteristic position indicated in the figures.

This moss has perhaps been given a more careful study than any other species; it is described in nearly every text book on botany. There are several other species in the United States, but this is the only one commonly found. The capsules mature early in June.

THE URN MOSS

THE Urn Moss is common on earth in conservatories, by roadsides and in old fields. It is abundant in moist places by paths in the parks of Greater New York. It must be collected in May to get the calyptra in position.

Fig 18. *Physcomitrium turbinatum* × 4; capsule × 15.

Although a very near relative of the Cord Moss, it entirely lacks the peristome which is so conspicuous in that species.

A much rarer moss, Pottia, may be found and confused with the Urn Moss, which it closely resembles. Pottia, however, is smaller, matures its capsules in winter, and under a lens will be seen to have the midrib excurrent instead of ending below the apex of the leaf, as in the Urn Moss.

There are several species of the Urn Moss, but the one figured [*Physcomitrium turbinatum* (Mx.) Brid.] is much the most common and most likely to be met with.

THE BRYUMS

BRYUM is perhaps the most difficult and troublesome of all the genera of mosses. The genus is large (500 species, 195 in Europe and America), and the distinctions between the species are often few and difficult to observe. There are, however, two species that can be recognized readily by anybody.

The Silvery Bryum (*B. argénteum* L.) grows everywhere at almost all altitudes. It is specially fond of dry compact soil in sandy fields and waste places. It grows abundantly in paths and between the bricks of sidewalks in towns and cities.

When fully grown it is a bright silvery gray, due to the fact that the leaves are white and without chlorophyll when old. The

Fig. 19. *Bryum argenteum* × 4; branch × 10; capsule × 20.

young plants are green and may easily be mistaken for something else. The leaves end in a slender bristle and are crowded and closely overlapping, making the stems and branches prettily julaceous.

The capsules mature in autumn, but can be found in recognizable condition at almost any season. When fully mature the seta and capules are dark red.

The Giant Bryum [*B. proliferum* (L.) Sibth.] is the largest and showiest of all our species, and, when moist and fully expanded, is a striking object in any situation. The stems spring from stolons and are nearly leafless except at the summit, where the very large leaves form a rosette. Under favorable circumstances it forms large mats on old rotten logs or at the base of trees in rich peaty soil. Although common, it seldom fruits in either America or England, but reproduces freely by its stolons.

Fig. 20. *Bryum proliferum* × 1; leaf and capsule × 4.

THE LONG-NECKED BRYUM

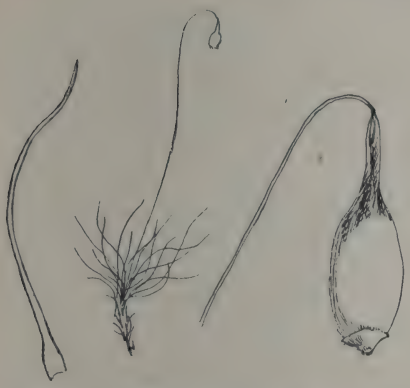


Fig. 21. *Leptobryum pyriforme* × 2; leaf and capsule × 10.

THE Long-necked Bryum [*Leptóbryum pyrifórme* (L.) Wils.] is closely allied to the true Bryums, although placed in another genus. It is easily recognized by its long-necked capsule and slender hair-like leaves.

It is rather rare, growing on moist shaded cliffs and on rocks near water. The capsules mature in June and July.

Some species of *Pòhlia*, an allied and difficult genus, have very long-necked capsules, but the leaves are so much wider, that there is no need of confusing them with the Long-necked Bryum.

THE BARTRAMIAS

THE Bartramias grow in moist niches in cliffs and on moist shady banks, looking much like tufts of green wool. The characteristic thing about them is their capsules, which are globular and somewhat unsymmetric when moist, but dry

Fig. 22. a, *Bartramia pomiformis* × 1. b, *B. Oederi* × 1. c, Capsule of *B. pomiformis* × 10, and e, Mouth of same with operculum. d, Capsule of *B. Oederi* × 10. f and g, Leaves of *B. pomiformis* and *B. Oederi* respectively, × 10.

with regular folds and alternate ridges. When very dry the body of the capsule becomes so shrunken as to be smaller than the mouth of the capsule itself.

We have two species, the Long-leaved Bartramia or Apple Moss [*B. pomiformis* (L.) Hedw.], easily distinguished by its longer leaves and larger capsule from the Short-leaved Bartramia [*B. Oederi* (Gunn.) Swartz]. The leaves of the Long-leaved Bartramia are also much more contorted or crisped when dry. It is common throughout our range whenever the country affords a suitable habitat, but the Short-leaved Bartramia is rather rare. The difference between the species is so marked that they cannot be confused.

Both species mature their capsules in spring; the Long-leaved Bartramia in April or early May, and the Short-leaved two or three weeks later.

PHILÓNOTIS

THE only species of Philonotis likely to be met with [*P. fontàna* (L.) Brid.] is very common where water drips or runs in shallow streams over rocks. When in fruit it may be mistaken for a Bartramia on account of the similarity of the capsules. The capsules of Philonotis, however, have a protuberance on the lower side that is entirely lacking in Bartramia.

Fig. 23. *Philonotis fontana* × 1; leaf, capsule, and male head × 10.

Philonotis grows in much wetter places, has much longer more slender stems that are often fasciculately branching at the top; shorter, more acute leaves, and is dioicous. The male heads are conspicuous objects among the fruiting plants, though seldom appearing in sterile mats. Although Philonotis is common, the sporophyte is infrequent. The capsules mature in May or June.

GYMNÓCYBE

THE Common *Gymnocybe is very abundant in swamps and wet shaded hollows. It is rather lighter in color than most of the accompanying mosses. When in fruit it is readily distinguished by its capsules, deeply furrowed when dry. From the figures the capsules might possibly be confused with those of

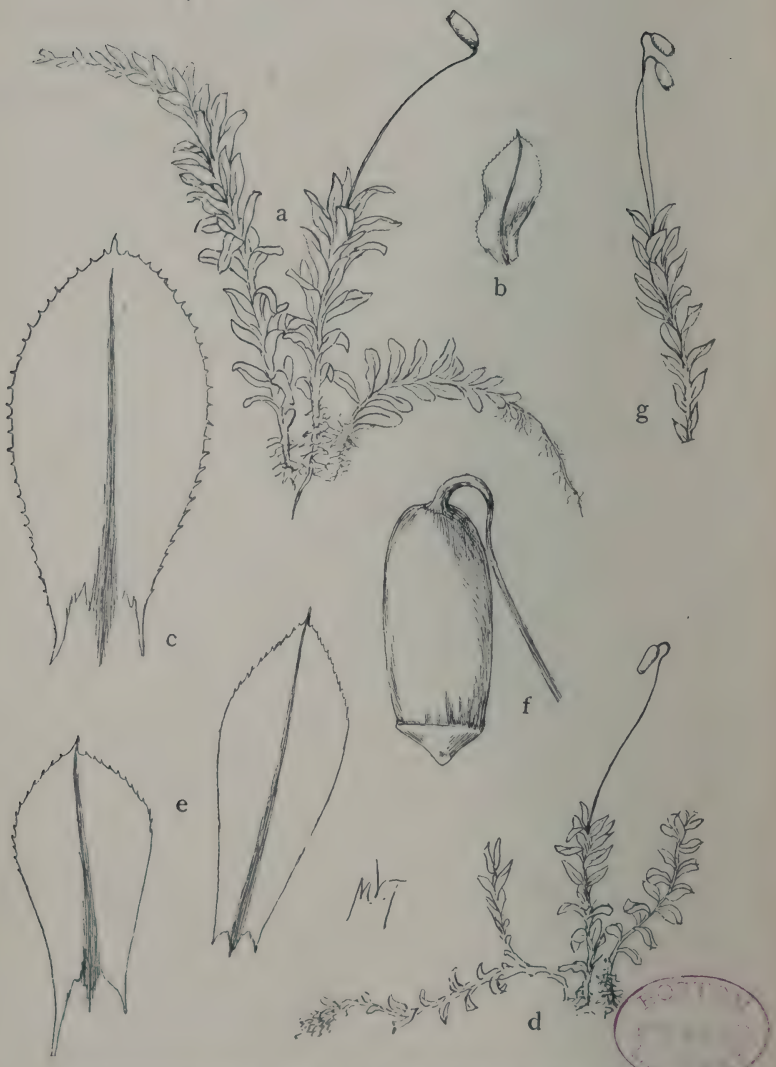
Gymnócybe palústris (L.) Fries.—*Aulacomnium palustre* Schwaegr.

Ceratodon, but they are much longer and much lighter colored (yellow-brown). The plants are several times as large as those of Ceratodon, often reaching a height of two or three inches. Note also the difference in habitat.

Fig. 24. *Gymnocybe palustris* × 10; capsules × 10; pseudopodia × 4.

When not in fruit, Gymnocybe frequently bears on the end of the stem a number of long slender pseudopodia, which, when young, bear clusters of gemmæ at their ends. These gemmæ serve to reproduce the plant asexually and may account for the rather infrequent appearance of the sporophyte.

The capsules mature in early summer.



EXPLANATION OF PLATE V.—a, *Mnium affine ciliare* × 1. b, Leaf × 4. c, Leaf × 10. d, *M. sylvaticum* × 1. e, Leaves of different shapes × 10. f, Capsule × 10. g, *M. Drummondi* × 1.

THE MNIUMS

THE Mniums are closely related to the Bryums, but in habit and general appearance are different enough so that they can usually be distinguished without difficulty. As a rule, the plants are larger and broader. The Giant Bryum, however, looks very much like the Mniums.

There are numerous species of Mnium, many of them common. We have about six that are common enough and sufficiently well characterized to warrant description here.

One of the first signs of vegetable life in early spring is the array of upright green sporophytes of the Woodsy Mnium, which is common in lawns and parks in moist shady corners, and is to be found abundantly in moist woods everywhere, growing, sometimes on the soil, sometimes on rotten wood. The capsules mature in May, but can be found in recognizable condition until August.

The Toothed Mnium closely resembles the Woodsy Mnium in many respects, but is easily distinguished by the leaves. The leaves of the Toothed Mnium are serrate with very long and slender teeth, which extend to the base of the leaf. In the Woodsy Mnium the leaves are serrate with shorter teeth that do not extend much below the middle of the leaf. Until one has had some practice, it may be necessary to mount the leaves in order to see the serration plainly. No reliance should be placed on the shape of the leaves in distinguishing these two species, as the leaves vary greatly in shape in different plants and on different parts of the same plant.

Drummond's Mnium is a very large single-toothed species, not uncommon on moist rocky banks of brooks. It nearly always produces several capsules from each fruiting plant.

The-Red mouthed Mnium is a fourth species somewhat resembling the Woodsy Mnium and growing in similar situations, but less common and usually growing in woods. The peristome is a very bright red, and after the operculum has fallen it makes a very conspicuous red band about the mouth of the capsule. If the leaves of the Red-mouthed Mnium be carefully studied, the teeth on the margins will be seen to be in pairs. To see this with a hand-lens requires considerable care, as the teeth are small and hide one another. The capsules mature at least two weeks later than those of the Woodsy Mnium.

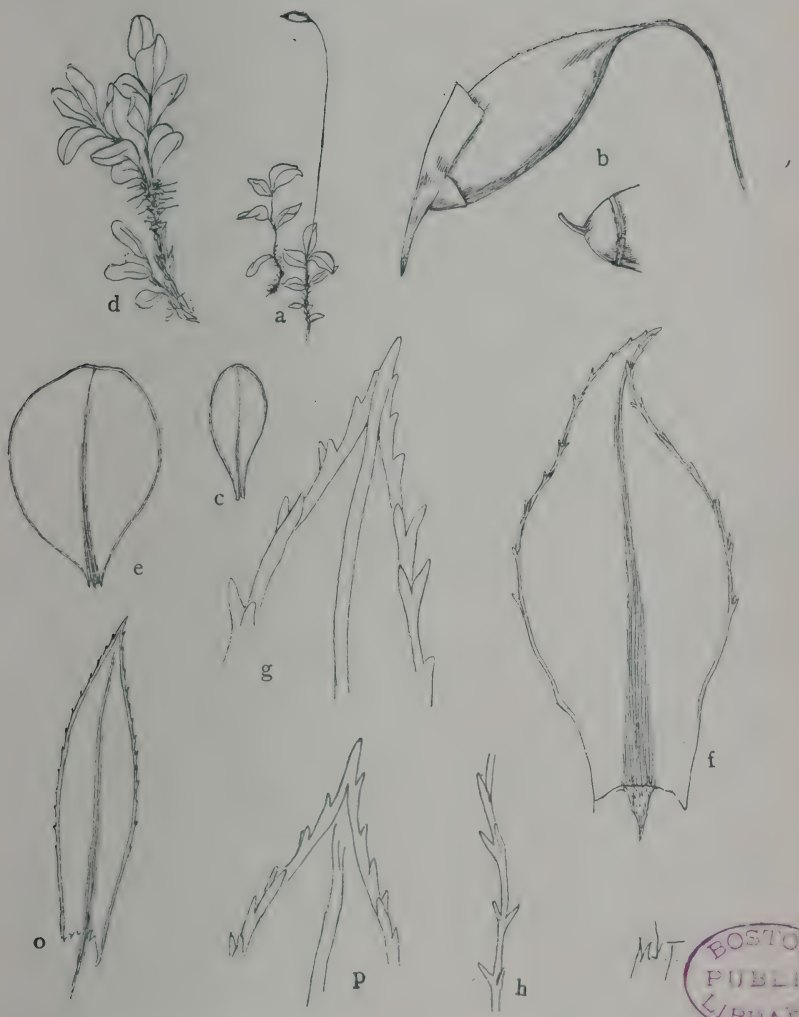
There are several species of these double-toothed Mniums, but the only other one readily recognizable with a simple lens is the Long-leaved Mnium, whose leaves are proportionately much longer and narrower, with the costa ending below the apex. It is dioicous and the disc-like male heads are an additional aid in identification. This species is more abundant southwards and is frequent around New York City in shaded springy places, but is not always easy to obtain in fruit.

The Early Mnium grows on moist stones in the bed of brooks. It matures its capsules in April, long before any other species. It is at once recognized by its entire obovate leaves and beaked operculum.

The Large-leaved Mnium is said to be merely a variety of the Early Mnium growing in the mud in swampy places. It is often much larger than the figure, sometimes having leaves half an inch long. The leaf cells are so large as easily to be seen with a lens and in some cases with the naked eye of a trained observer.

KEY.

1. Leaves entire, ... 2.
   Leaves serrate, ... 3.
2. Growing on rocks in the bed of brooks, ... Early Mnium (*M. punctàtum* L.)
   Growing on soil in shaded swampy places, ... Large-leaved Mnium (*M. punctàtum elàtum* Schimp.)
3. Capsules clustered, ... Drummond's Mnium (*M. Drummóndii* B. & S.)
   Capsules single, ... 4.
4. Leaves serrate to base, ... Toothed Mnium [*M. affine cilìare* (Grev.) C. M.]
   Base of leaves entire, ... 5.
5. Leaves oblong-lanceolate, 5:1, ... Long-leaved Mnium (*M. hórnum* L.)
   Leaves oblong, rounded, or obovate, ... 6.
6. Mouth of capsule red, ... Red mouthed Mnium (*M. spinulòsum* B. & S.)
   Mouth of capsule not red, ... Woodsy Mnium (*M. sylvàticum* Lindb.=*M. cuspidàtum* Hedw.)



BOSTON PUBLIC LIBRARY

EXPLANATION OF PLATE VI.—a, *M. punctatum* × 1. b, Capsule and operculum × 10. c, Leaf × 4 d, Var. *elatum* × 1. e, Leaf of var. *elatum* × 4. f, Leaf of *M. spinulosum* × 20. g and h, Apex and margin of same × 40. o, Leaf of *M. hornum* × 10. p, Apex of the same × 40.

ANÓMODON

THE bases of trees in cool moist woods frequently wear an apron of dark green, extending from the roots to three or four feet above the ground and often entirely encircling the trunk. This "apron" is usually composed of one or more species of Anomodon, often mixed with an Hepatic (*Porella*). The mats of Anomodon are quite thick and are composed of a network of nearly leafless stems, growing close to the bark and sending out the crowded branches that compose the "pile" of the mat. The Anomodons are nearly all rather large coarse mosses with the sporophyte arising from the *branches*. The capsules are conic-cylindrical, straight, and erect.

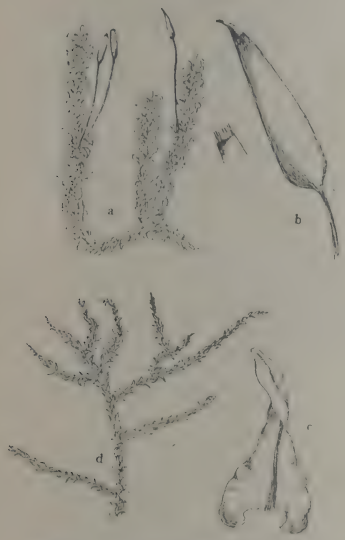


Fig. 25. a, *Anomodon apiculatus* × 2. b, Capsules × 10. c, Leaf × 10. d, Branch of *A. attenuatus*, moist, × 2.

Some species of Leskea grow in similar situations and have a very similar sporophyte, but the Leskeas are much smaller, do not produce such dense mats, and the sporophyte arises from the *stem*.

There are three species of Anomodon growing on trees as described above: The Common Anomodon (*A. apiculàtus* B. & S.), the Blunt-leaved Anomodon [*A. mìnor* (P. Beauv.) Fuern. = *A. obtusifolius* B. & S.], and the Slender Anomodon [*A. attenuàtus* (Schreb.) Hueben.].

The Common Anomodon and the Blunt-leaved Anomodon resemble each other so closely that it is not easy to distinguish them without a compound microscope. Both have simple blunt branches and grow almost exclusively on trees. The Slender Anomodon grows freely on rocks as well as on trees, its branches are slender and tapering, and freely branched. It almost never fruits.

There are several other rock-growing species too difficult for treatment here.

THÈLIA

THE Common Thèlia [*Thèlia hirtélla* (Hedw.) Sulliv.] is very common in the southern and coastwise portion of our range. It grows almost exclusively on the bark of stumps and the bases of trees. It forms thin closely adherent mats, easily recognized by their whitish-green color, erect symmetric capsules with whitish peristome, julaceous branches, and concave suborbicular leaves. The capsules mature in autumn.

Fig. 26. *Thelia hirtella* × 4; leaves × 20.

Thèlia asprélla (Schimp.) Sulliv. has a range and habitat very similar to that of *T. hirtella*, but is even lighter in color; when fresh, light glaucous-green. *T. Lescùrii* Sulliv. is very similar to the above named species but grows in rather *dry soil*. It is confined to the more southern coast regions; northern limit, Connecticut. It rarely produces capsules, while the other species fruit freely.

THE FERN MOSSES

THE Fern Mosses (*Thuidium*) have been noted by every lover of out-of-door life because of their delicate and beautiful fern-like form. The branches are given off very regularly like the pinnæ of a fern, and the branches themselves often give off branchlets as regularly as the pinna of a fern is divided into pinnules.

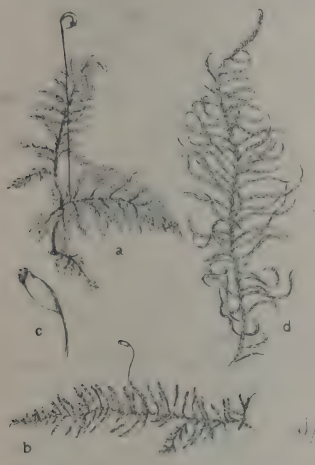


Fig. 27. a, *Thuidium delicatulum* × 1. b, *T. scitum* × 1. c, Capsule of the same × 5. *T. abietinum* × 1.

The Common Fern Moss [*T. delicátulum* (L.) Mitt.] grows in damp shady places over stones and earth, rotten logs and the like. It is very regularly twice or even thrice pinnate. It grows abundantly in suitable situations throughout our range, but produces capsules rather sparingly. These mature in early autumn and are very large, much curved, and are borne on long stout setæ. The perichætial leaves bear long cilia along their upper margins. This is the only character by which this species can be distinguished readily from another closely related species [*T. recógnitum* (Hedw.) Lindb.], which is also a common plant.

Growing on the bark of trees are several smaller species that are usually only once pinnate. The Smaller Fern Moss [*T. scìtum* (Beauv.) Aust.] is the one most likely to be met with, especially in the northern portion of our range. The capsules, besides being much smaller, are only slightly cernuous and are nearly symmetric. The capsules mature in autumn.

Another simply pinnate species that is common is the Wiry Fern Moss [*T. abietìnum* (L.) B. & S.]. This moss is most frequently found in dry sterile places on the ground among the grass, and on ledges. It varies considerably in appearance according to habitat and its immediate condition as to moisture. Usually it is very evenly and regularly pinnate. Though frequent, it is very rarely found fruiting in our latitude. Mr. R. S. Williams, however, found it fruiting freely in Alaska. Mr. Williams also reports several other similar cases, one of the most conspicuous being *Hypnum rugosum* L.

THE MOUNTAIN FERN MOSS*

THE Mountain Fern Moss, although belonging to a different genus from the other fern mosses, is best treated in connection with them because of its similarity in form. As will be seen by the figures, it is much larger and has a very peculiar

Fig. 28. *Hylocomium proliferum* × 1.

and characteristic habit. Every year each of the main shoots of the previous year develops a single fern-like shoot from the middle of the upper side instead of branching out from the side of the shoot as in the case of most mosses. This gives the plant its peculiar habit and its botanical name of "*proliferum*." It is one of the too rare cases in which the botanical name is descriptive of the plant to which it is applied.

This moss grows abundantly in cool moist mountain woods on stones and old logs. When found growing elsewhere it is so stunted as to give no idea of its beauty in its favorite habitat. The capsules, which mature in autumn, though not rare, are sparingly produced in proportion to the number of plants. When a patch does fruit, however, it often fruits heavily.

Hylocomium proliferum (L.) Lindb.—*H. splendens* of many authors.

THE SHAGGY MOSS

THE Shaggy Moss [*Hylocòmium triqutrèum* (L.) B. & S.] is common on shaded banks that are neither extremely wet or very dry. Its branches usually come out irregularly as illustrated in the figure and its leaves stand straight out from the stem, giving it its characteristic ragged appearance. Sometimes in moist mountain woods it branches regularly and grows to a height, or rather length, of five or six inches, so that one is with difficulty persuaded that it is the familiar moss of every day acquaintance. The stems are very stout and stiff but elastic, or "springy." Because of its elasticity this moss is sometimes used for packing china and other brittle objects.

Fig. 29. *Hylocomium triquetrum* × 1; stem leaf × 4.

Although the Shaggy Moss is common, its capsules are rather infrequent. They mature in winter or early spring; when dry they are often regularly furrowed with deep wide furrows.

THE HYPNUM FAMILY

THE two preceding species belong to the great Hypnum Family, which contains a vast number of our common mosses. The majority of the members of this family are slender and prostrate, or creeping with ascending branches. The sporophyte varies a good deal, but the capsules are more or less unsymmetric and cernuous in most species. The members of this family usually grow in dense thin mats on soil, stones, rotten wood, and bark of trees. There are hundreds of species belonging to this family and the number within our own range is very large. Many of the species and even genera are so closely related and are distinguished by so few and so minute differences that no one but a trained and expert student of mosses can name them correctly. For this reason only a few of the most strongly marked species can be treated here. This is to be regretted, for many of the commonest mosses will thus be omitted and the student will be discouraged by finding so many things that he cannot identify. It is safe advice to the beginner to leave the Hypnums until he has studied the more easily recognized mosses.

Roughly, the more common genera are distinguished thus: *Plagiothecium* and *Entodon* are flattened in a plane parallel to the substratum, but the capsules of Entodon are erect and symmetric, while those of *Plagiothecium* are curved and cernuous. *Brachythecium* has very short ovoidal capsules that are cernuous and somewhat curved (except *B. acuminatum* and *B. oxycladon*); the leaves have a strong midrib. *Eurhynchium*, *Cirrphyllum*, and *Rhynchostegium* have the strong midrib and short capsules of *Brachythecium*, but the opercula are grotesquely long-beaked, much as in *Dicranum*. *Raphidostegium* has long-beaked capsules like the three genera mentioned above, but the leaves lack the midrib. *Pylaisiella* grows exclusively on the bark of trees, and is dark green; the short branches are strongly curved at the end when dry, and the capsules are erect and symmetric. *Hypnum* has so many varying forms that one can best get an idea of it from studying the individual species described below.

HYPNUM

In one section of this composite genus the leaves are all turned to one side (secund), and the branching is more or less regularly pinnate, giving the plants a plume-like appearance in many cases. The leaves are without midrib. This section is

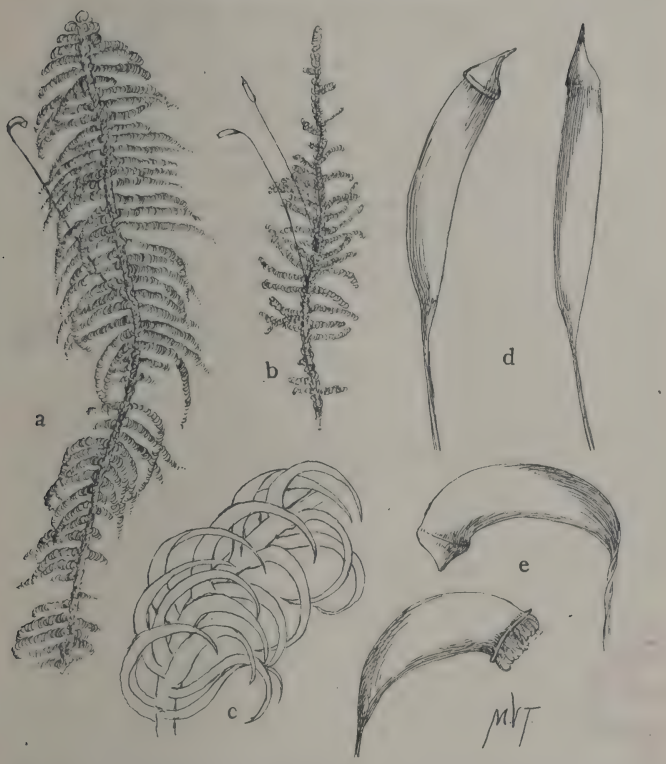


Fig. 30. a, *Hypnum crista-castrensis* × 1. b, *H. imponens* × 1. c, Portion of branch of *H. crista-castrensis* × 10. e, Capsules × 10. d, Capsules of *H. imponens* × 10.

often called *Hypnum* proper. Two of the most common and easily recognized mosses of this group are the Plume Moss (*Hypnum crista-castrénsis* L.) and the Pinnate Hypnum (*H. impónens* Hedw.) The Plume Moss is common on decayed wood and stumps in cool moist woods in New England and New York, and probably throughout our range. A few starved specimens have been collected on Long Island. To be appreciated, this moss should be seen in the cool moist recesses of the primeval mountain forests, where it covers the fallen and decaying trunks of huge trees with ample robes of richest texture. The shoots are ascending and as regularly pinnate as any feather, even to the triangular apex of the shoot. Its color is a light yellow-green.

Its capsules are strongly curved and cernuous; they mature in autumn.

The Pinnate Hypnum is a much more common moss in the lowlands and grows almost exclusively on rotten wood in moist shady places. It somewhat resembles the Plume Moss, but is prostrate, forming dense closely cohering mats. It is also darker green; the capsules are nearly erect and symmetric, and the pinnate branching stops short of the apex of the shoots, as is shown in the figure. A careful examination will show that there is a difference in the curvature of the leaves; in the Pinnate Hypnum the leaves curve towards the substratum at right angles to the plane of the stem, while in the Plume Moss they curve towards the branch next below on the stem. The capsules of the Pinnate Hypnum are produced much the more freely; they mature in winter, but persist in good condition for a long time.

Hypnum curvifòlium Hedw. is a much rarer moss that resembles *H. imponens* when sterile. It is more confined to the mountains, is larger, lighter colored, and has curved cernuous capsules that are very strongly furrowed when dry, looking much like those of the Fuscous Dicranum (Fig. 7).

Hypnum rèptile Mx. is another regularly pinnate moss of this group, but it is less than half the size of the three described above. Its general appearance is fairly well represented in Fig. 27, b, but the capsules are longer and more curved. With a lens the leaves of the *Thuidium* will be seen to be acute and straight, while those of the *Hypnum* are curved and long acuminate. The *Thuidium* grows in thin mats so that its pinnate character is easily seen at a glance; the *Hypnum* grows in such densely interwoven mats that it is often necessary to disentangle it before its pinnate character becomes apparent. *Hypnum reptile* matures its capsules much earlier than any of the three other species mentioned above. They are usually fully ripe in August.

Wherever rotten wood is found in moist shaded places, there the Common Hypnum (*H. Haldanianum* Grev.) is almost sure to grow, covering the unsightly masses of rotten wood with its upholstery of bright green. It is one of our commonest mosses and nearly always fruits freely.

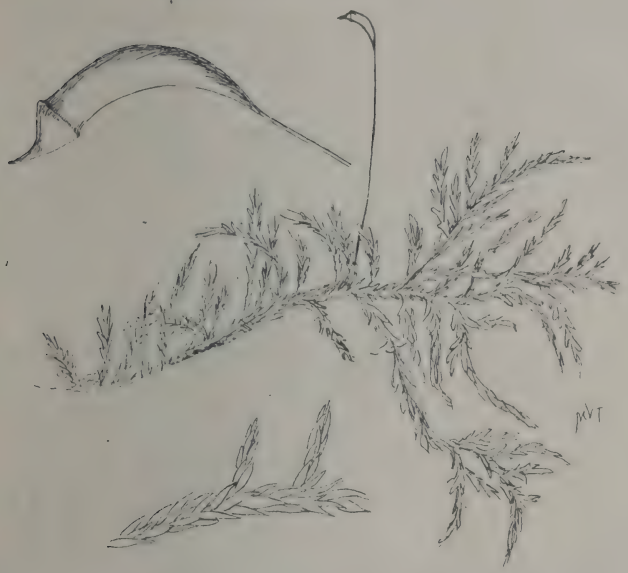


Fig. 31. *Hypnum Haldaniànum* × 2; branch × 5; capsule × 10.

The Common Hypnum in appearance is very little like the species previously described; the leaves are straight and equally spreading on all sides, not secund. The capsules are cylindrical and somewhat curved, much like those of the Pinnate Hypnum, only larger. They mature in late autumn or winter, but remain in fairly good condition until the next summer.

The Long-capsuled Brachythecium [*B. oxýcladon* (Brid.) J. & S.] sometimes grows on decaying wood and then is scarcely to be distinguished from the Common Hypnum with certainty unless the leaves be examined with a high-power lens, when they will be seen to have a strong midrib. The capsules are usually much darker than those of the Common Hypnum. The usual habitat of the Long-capsuled Brachythecium is on moist ledges and rocks.

Fig. 32. *Hypnum Schreberi* × ½.

SCHREBER'S HYPNUM

Schreber's Hypnum (*H. Schréberi* Willd.) is the bright yellow-green moss that forms dense deep cushions by almost every moist shaded roadside in inland country regions. It is abundant in moist pastures and open woods, and sometimes makes its most luxuriant growth in a sphagnum bog. It is so common, so conspicuous, and withal so large, that every one must have noticed it at some time or other. The stems are often four to six inches long and nearly erect, and crowded so closely together as to form dense soft cushions into which the foot sinks deeply. Examined closely, the stems appear a bright red through the semi-transparent leaves.

The cut of this moss is the only attempt in the book to illustrate by means of photography. The results did not warrant a farther trial. Mosses are too dark and too small to photograph successfully.

Schreber's Moss has broad obtuse leaves and is put by some botanists in a subgenus of Hypnum, by others in Hylocomium. The capsules mature in autumn; they are not so frequent as one would expect from the abundance of the gametophyte.

THE HOOKED MOSSES

GROWING on stones, earth, and decayed wood in shaded swamps, on edges of brooks, and shores of lakes and streams will be found another type of Hypnum with strongly secund and hooked leaves. These mosses belong to the subgenus Harpidium. As a rule the Hooked Mosses are much larger

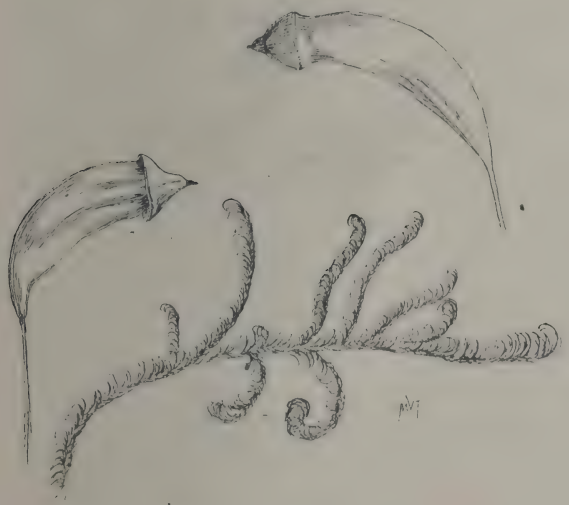


Fig. 33. *Hypnum uncinatum* × 1; capsules × 10.

than the true Hypnums and are seldom or never regularly pinnate. The leaves at the end of the branches are specially noticeable for their hook-like appearance. Mounted and examined with a high-power lens, the leaves will be seen to have a well developed midrib, which at once distinguishes them from those of the true Hypnums.

The species of this subgenus are, perhaps, the most puzzling of any of the Hypnum Family and it is entirely useless to endeavor to enable anybody to distinguish the species without the use of a compound microscope.

The species figured (*Hypnum uncinàtum* Hedw.) is the most common member of the subgenus. It is most frequently found on damp stones, more rarely on soil. The capsules are usually produced freely, maturing in autumn.

THE WATER-LOVING HYPNUMS

THERE are several species belonging to the Hypnum Family that grow on the stones in the bed of brooks, particularly in mountain regions. They do not belong to one genus, but their similarity of habitat, often combined with similarity in appearance, makes it easier to study them together.

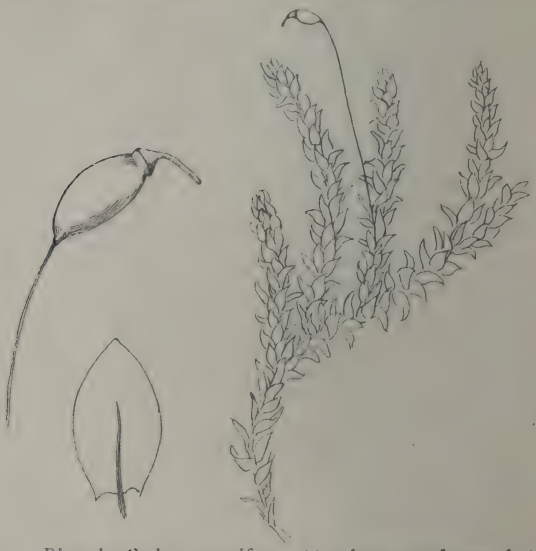


Fig. 34. *Rhynchostègium rusciforme* × 2; leaves and capsule × 10.

Two of these, the Beaked Water Moss [*Rhynchostègium rusciforme* (Neck) B. & S.] and the Round-leaved Hypnum (*H. dilatàtum* Wils.) grow on stones in the middle of brooks and are partially submerged, or at least wet with spray, during the entire year, and are submerged except at low water. These mosses are very dark, almost black, except the youngest portion of the plants, and the leaves are very broadly ovate to almost orbicular, and obtuse or very bluntly acute.

The Beaked Water Moss is the coarser of the two, with broadly ovate costate leaves and strongly beaked capsules, which latter mature in September. They are frequently produced in large quantities and present a very pretty appearance indeed against the dark background of the gametophyte.

The Round-leaved Hypnum belongs to the subgenus *Hygrohypnum*. Its leaves are suborbicular and nearly ecostate. The

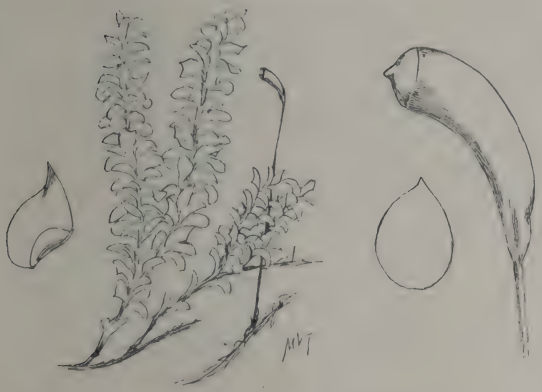


Fig. 35. *Hypnum dilatatum* × 3; leaves and capsule × 10.

capsules are not beaked. They mature in July according to Limpricht, but in autumn according to my observations.

The Round-leaved Hypnum is frequent in mountain streams, but has formerly been referred to another closely related species (*H. molle* Dicks.), a much rarer moss with ovate-elliptical leaves.

There are several other species of *Hygrohypnum* that may be found in water. One of these (*H. ochràceum* Turn.) may be recognized by its yellowish or ochre-green color and strongly secund leaves.

THE BRACHYTHÈCIUMS

THE Brachytheciums, as previously stated (p. 36), are distinguished by their short thick unsymmetric cernuous capsules, and leaves with a well developed midrib. There are at least two species of Brachythecium that should be classed among the water-loving members of the Hypnum Family, although they are not so thoroughly aquatic as the two species just described.

The Rivulet Brachythecium (*B. rivulàre* B. & S.) loves best the wet gravelly soil at the edges of cool swift brooks. Frequently it will entirely cover the gravelly bottom of a mountain stream that is nearly dry during the summer. It is submerged at times of high water and never grows in places that become entirely dry; occasionally it will grow submerged, but even then it is attached to the gravel at the bottom of the stream and not to the stones, as in the case of the two preceding species. When

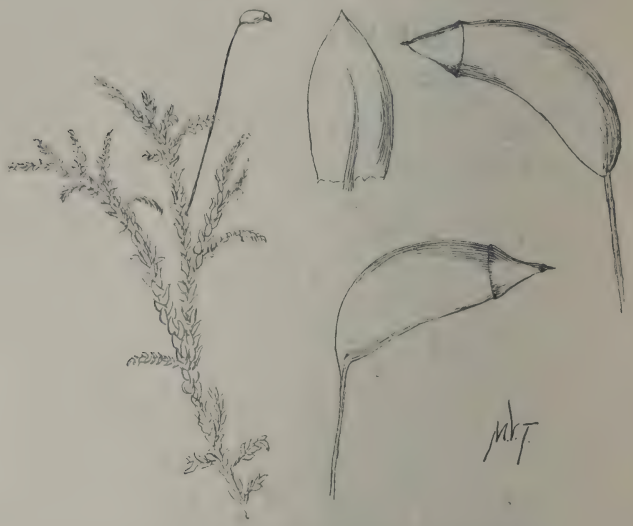


Fig. 36. *Brachythecium rivulare* × 1; leaves and capsules × 10.

growing submerged the stems of the Rivulet Brachythecium become greatly elongated, slender and sparingly branched, with few and distant leaves. It is always much lighter colored than either the Beaked Water Moss or the Round-leaved Hypnum; the leaves are rather smaller, ovate and obtusely acute. The branch leaves are usually much smaller than the stem leaves. The stems are often tall and stout, with a shrub-like habit. The capsules are not beaked, they mature in autumn.

Brachythècium plumòsum (Sw.) B. & S. grows on rocks in the bed of brooks, but is not submerged except at high water. The difference in habit alone is sufficient to distinguish it from *B. rivulare*, but it is also much smaller, darker green, more closely applied to the substratum, nearly prostrate, with acuminate stem leaves.

B. populeum (Hedw.) B. & S. is a much more slender species growing on boulders, often near streams, but never on stones regularly submerged at high water. In this species the midrib runs to the very apex of the leaf.

Two other species of Brachythecium are treated elsewhere (pp. 36 and 50).

RAPHIDOSTÈGIUM

THE Common Raphidostegium [*R. recúrvans* (Mx.) J. & S.] looks very much like one of the true Hypnums with irregular branching. It is a bright yellow-green and grows in dense mats on rotten stumps and logs in wet shaded places. It

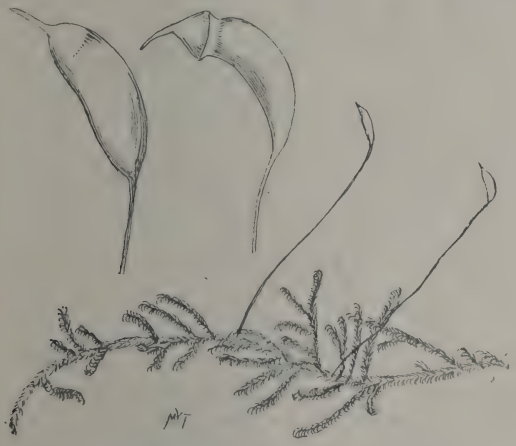


Fig. 37. *Raphidostègium recúrvans* × 2; capsules × 10.

is common throughout our range, but I have rarely seen it in fruit in the vicinity of New York City. The chief distinction from the true Hypnums lies in the very short capsules with lid very long beaked. Until one becomes familiar with it, it is hard to recognize unless in fruit. The capsules mature in autumn and are often produced in great profusion.

THE BEAKED MOSSES

AS has been previously stated, the Beaked Mosses (*Eurhynchium*, *Rhynchostegium*, and *Cirriphyllum*) are very closely allied to *Brachythecium*, differing mainly in the long-beaked operculum. One of these, the Beaked Water Moss, has already been described on page 42.

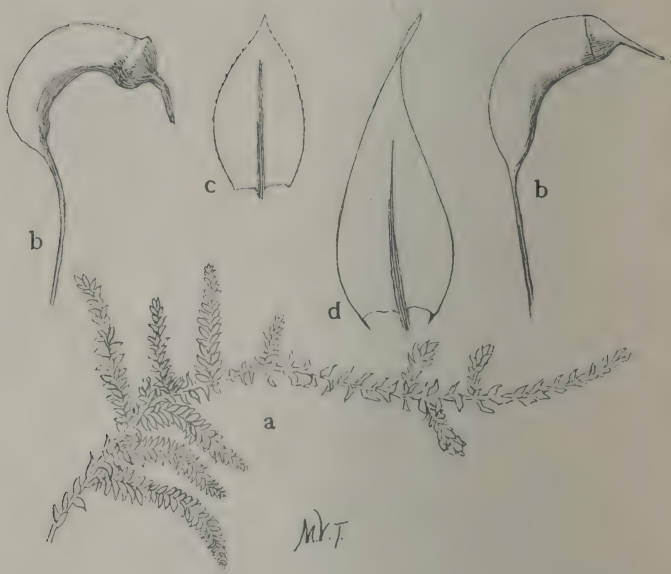


Fig. 38. a, *Eurhynchium hians* × 2. b, b, Capsules × 10. c, Leaf × 20. d, Leaf of *Rhynchostegium serrulatum* × 10.

There are several species of Beaked Mosses that belong in genus *Eurhýnchium* that are fairly common, but it is doubtful if they can be accurately determined without the aid of the compound microscope. The Light Beaked Moss [*Eurhýnchium hìans* (Hedw.) J. & S.] is very common on sandy soil in the lowlands. It is abundant in the public parks of Brooklyn, but rarely fruits there. It prefers damp places, not wet. The leaves spread so that the branches appear flattened in a horizontal plane. When fresh, the color is a peculiar shining light yellow-green. The branch leaves are usually bluntly acute. The capsules are produced sparingly, maturing in October.

The Dark Beaked Moss [*Rhynchostègium serrulàtum* (Hedw.) J. & S.] is found in a similar habitat, but has a more southerly and coastwise range, and is more likely to be found near the base of trees. It is also flattened, but is a dark rich green in color and the leaves are much longer and more slenderly acuminate, as shown in the figure.

Fig. 59. *Cirriphyllum Boscii* × 4-3; branch × 5; leaves and capsule × 10.

The Spoon-leaved Moss [*Cirriphýllum Bóscii* (Schwaegr.) Grout] is one of the Beaked Mosses that is easy to recognize when in its normal condition. It grows in fields among the grass and on the ground in woods. Its leaves are very concave, being shaped much like the bowl of a spoon with a long twisted point added. The leaves are very regularly imbricated, making the branches turgid and very markedly julaceous, so that they look like little glossy yellow-green catkins. Although it gets as far north as southern Vermont, it is much more abundant southwards. It fruits sparingly, the capsules maturing in autumn.

THE PLAGIOTHECIUMS

THE stems and branches of the Plagiotheciums grow close to that upon which the plant grows (substratum) and the leaves are apparently in two rows, giving the plants a flattened appearance like that of the Dark and the Light Beaked

Fig. 40. a, *Plagiothecium denticulatum* × 2. b, Three capsules of the same × 10. c, Capsules of *P. sylvaticum* × 10.

Mosses. They are readily separated from these Beaked Mosses by the fact that the Plagiotheciums have leaves without a midrib or else with a very short and double midrib. The capsules are also an aid, as they are long and slender like those of Hypnum proper. The species are numerous and difficult to determine.

There are two species everywhere present that may perhaps be recognized with the aid of a brief description and the accompanying cuts. Both these species grow on humus in damp woods and shaded places; they grow at the base of trees and about rocks when there is a slight layer of humus for their nutrition.

The Slender Plagiothecium [*P. denticulàtum* (L.) B. & S.] is more slender in habit and has nearly symmetrical suberect capsules with the lid not beaked. The Woodsy Plagiothecium [*P. sylvàticum* (Huds.) B. & S.] is generally a much coarser plant with larger, curved and cernuous capsules having a long-beaked lid. The capsules of both species mature in summer.

PYLAISIÉLLA

PYLAISIELLA affects the habitat of the Grimmia Family in that it grows on the bark of living trees. It is readily distinguished from the members of that family by being pleurocarpous, by the long exserted capsules, by the lighter green

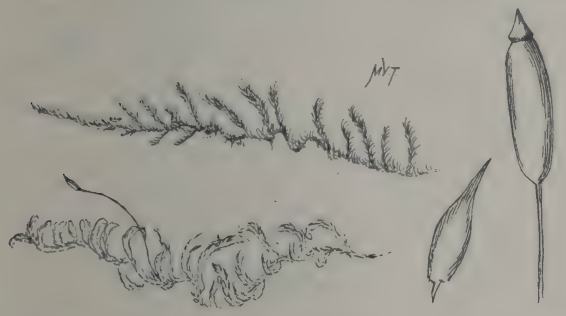


Fig. 41. *Pylaisiella Schimperi* × 10, wet and dry; leaf × 20; capsule × 10

color, and by having the branches somewhat hooked at the end when dry. Old apple trees in a rather dense orchard are a favorite habitat of the Common Pylaisiella [*P. Schimperi* (R. & C.) Grout=*Pylaisia intricata* of most authors]. It is also common on trees in the open woods and can be found on the shade trees of almost any of the smaller New England towns, but does not seem to thrive near the large cities. The plants grow closely interwoven and present the appearance represented in the figure only when disentangled. The erect subcylindric capsules mature in autumn.

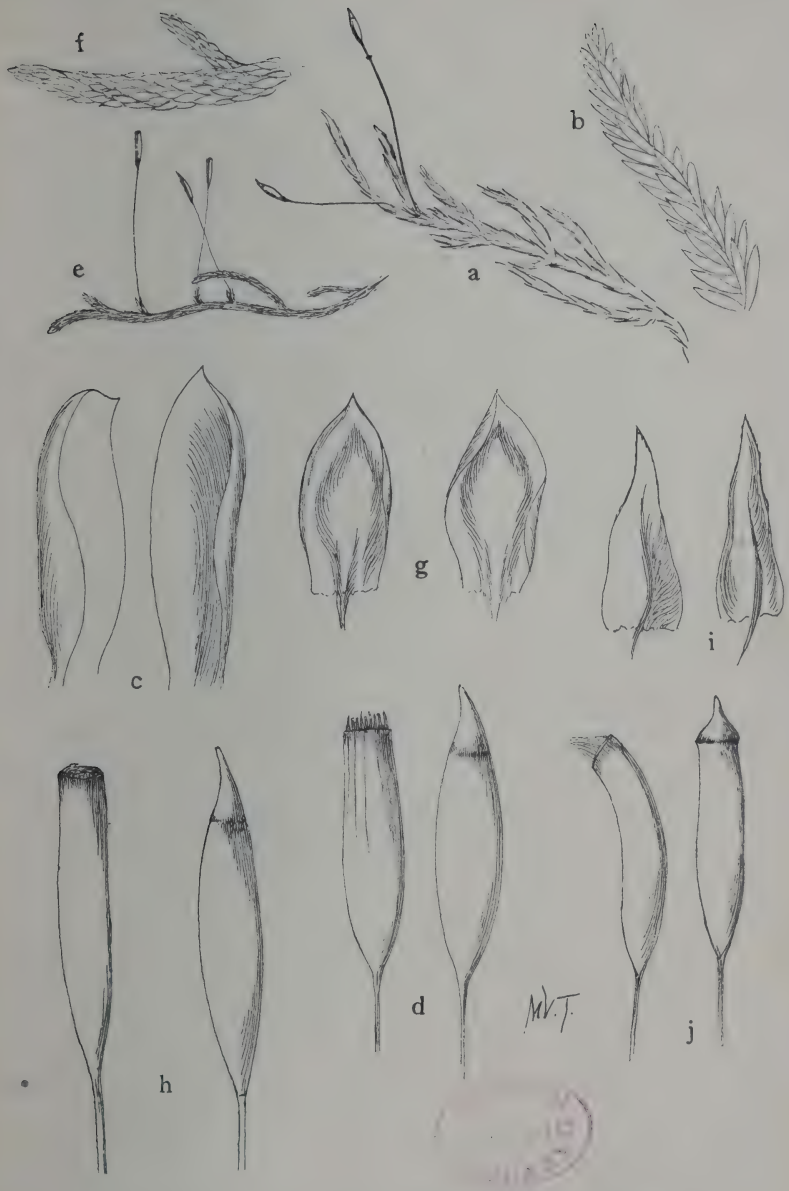
THE *ENTODONS

THE Entodons have erect symmetric capsules, ecostate very concave leaves and a beautiful glossy yellow-green color that enables one to recognize them without much trouble. The majority of the species are flattened, but have the appearance of being pressed flat instead of having the leaves apparently two-ranked as in Plagiothecium. The stems and branches, however, are round and julaceous with closely imbricated leaves in the round-stemmed Entodon [*E. seductrix* (Hedw.) C. Muell.], which is probably the most common species in the southern portion of our range. It grows on rotten wood, soil, moist rocks, bark of trees, etc.

The Flat stemmed Entodon [*E. cladorrhizans* (Hedw.), C. Muell.] is nearly always found on decayed wood, rarely on soil rich in humus. Its strongly flattened stem and branches easily distinguish it from the Round-stemmed Entodon. This character, together with the peculiar color characteristic of the genus, will differentiate it from species belonging to other genera. There are a number of other American species of Entodon that resemble the Flat-stemmed Entodon, but they are rare and not likely to be met with. The leaves of both species are very concave, but those of the Flat-stemmed Entodon are larger. Both species mature their capsules in autumn or early winter.

THE ERECT BRACHYTHECIUM [*B. acuminatum* (Hedw.) Kindb.] is often mistaken for the Round-stemmed Entodon. It has a similar habitat and very nearly the same range. It also has julaceous light-green branches and erect symmetric capsules. A careful examination of the leaves will enable one to decide at once to which of the two any given specimen belongs. The leaves of the Brachythecium are somewhat smaller, scarcely concave, ovate-lanceolate and gradually acuminate, and strongly costate. The Erect Brachythecium is an anomaly in the genus; it and its allies should probably be placed in a separate genus. It is not related to Entodon, but is treated in connection with it because of its similarity in appearance. Its capsules are occasionally somewhat curved. They mature in autumn.

*Entodon C. Muell.=*Cylindrothecium* B. & S.



EXPLANATION OF PLATE VII.—a, *Entodon cladorrhizans* × 1. b, Branch × 5. c, Leaves × 20. d, Capsules × 10. e, *E. seductrix* × 1. f, Branch × 5. g, Leaves × 20. h, Capsules × 10. i, Leaves of *Brachythecium acuminatum* × 20. j, Capsules of the same × 10.

THE TREE MOSSES

THE Tree Mosses (*Climàcium*) are perhaps the largest of the pleurocarpous mosses. They are very markedly tree-like in habitat, and this, together with their size, has always brought them to the notice of those accustomed to country life·

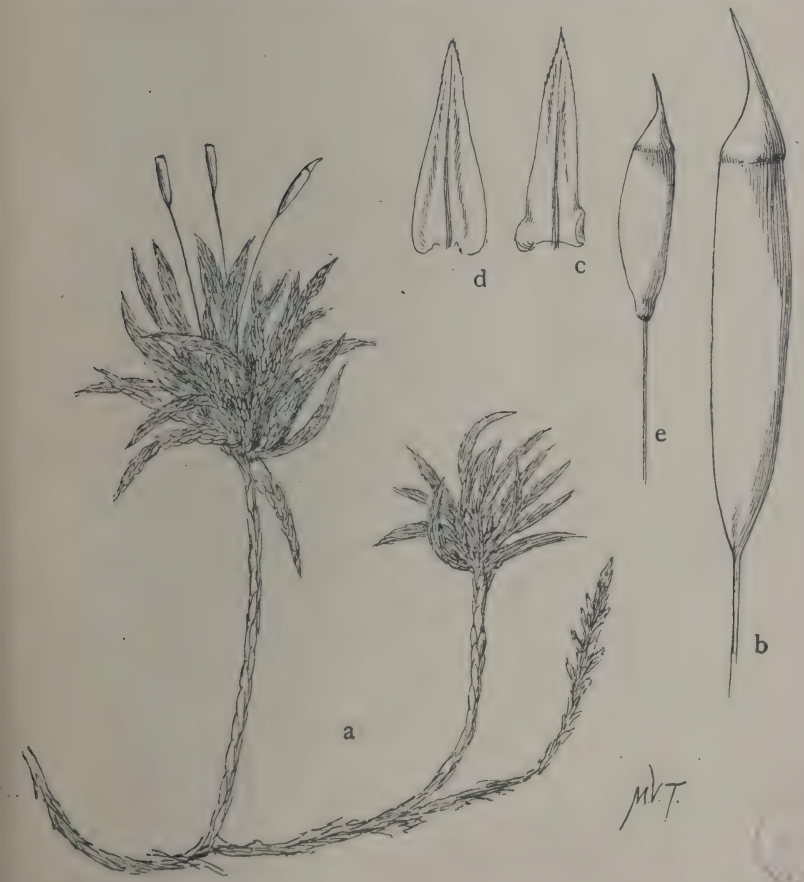


Fig. 42. a, *Climacium Americanum* × 1. b, Capsule × 10. c, Branch leaf × 10. d, Branch leaf of *C. dendroides* × 10. e, Capsule of the same × 10.

They are often mistaken for small forms of the Running Pine (*Lycopodium*). These mosses are common in moist or wet soil, particularly in wooded swamps, where their favorite habitat is around the bases of stumps, trees, or other similar elevations. They are also found in moist grassy places, but rarely fruit in the latter habitat, and infrequently in the former. The erect tree-like shoots grow from stolons that are partially or wholly under ground. These continue to grow horizontally, producing new shoots each year.

We have two species, the European Tree Moss [*Climacium dendroides* (L.) Web. & Mohr.] and the American Tree Moss (*C. Americanum* Brid.). The leaves of the American Tree Moss are usually much more closely appressed when dry and are much more conspicuously auricled; its capsules are nearly twice as long as those of the European Tree Moss. Both species mature the capsules in autumn. The European Tree Moss is a native of America as well as of Europe, but it was first described from the Old World. It is more common northwards, while the American Tree Moss is more common southwards. Both species are common in New England.

A third form of the Tree Mosses is common in swamps in the southern portion of our range. It grows close to the water and often down into it. It is prostrate or creeping, and rarely if ever assumes a tree-like habit. It has previously been called a variety of the American Tree Moss (*C. Americanum* var. *Kindbergii* R. & C.), or Kindberg's Tree Moss. It is named after Dr. N. Conrad Kindberg, of Linkoeping, Sweden, who has determined Professor Macoun's Canadian Mosses. This form is very abundant in the swamps of Long Island. It looks like a very coarse Hypnum with large erect symmetric capsules. It fruits freely, the capsules maturing in early autumn.

*NÉCKERA

NECKERA is found almost exclusively on the trunks of deciduous trees in cool moist woods, rarely on ledges or cliffs in similar situations. Neckera rarely grows near the base of a tree, nearly always growing well above that por-

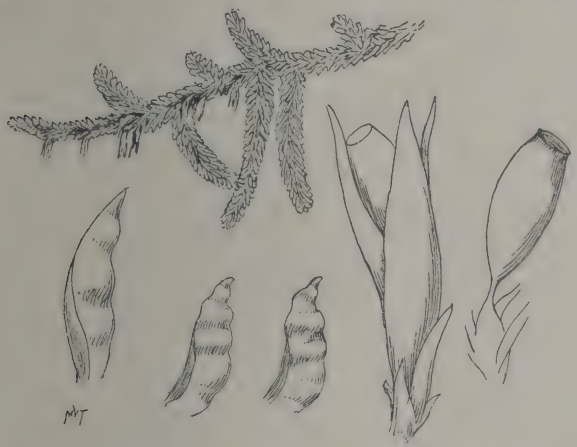


Fig. 43. *Neckera pennata* × 1; leaves × 10; capsules, with and without perichætial leaves × 10.

tion of the trunk occupied by Anomodon or Leskea, and extending upwards to a height of from twenty-five to fifty feet, according to the size of the trees and the density of the wood. Neckera is clearly characterized by its flattened branches, having wavy leaves, and its immersed capsules pendent from the lower side of the branches. The branches usually extend out from the tree trunk at an angle of from 45 to 75 degrees. The capsules are produced on the older portions of the plant, often in great numbers. They mature in summer.

*The only species likely to be met with in our range is *N. pennàta* (L.) Hedw.

THE LEUCODONS

LIKE Neckera, Leucodon grows some little distance up on the trunks of deciduous trees. It is often difficult to collect because it grows beyond one's reach. The branches hang downward and outward, and sometimes have an upward curve at

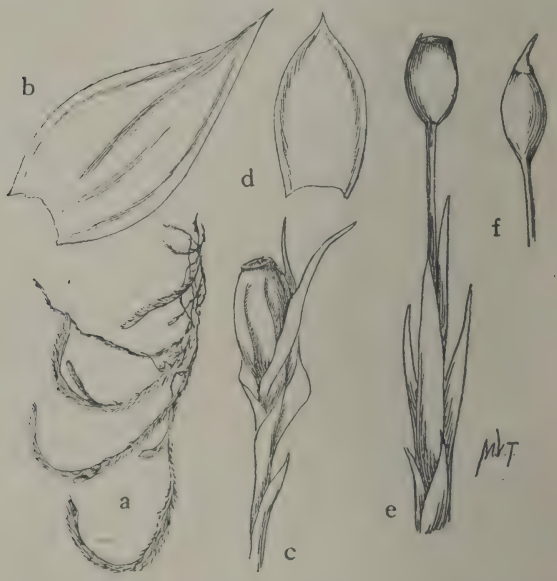
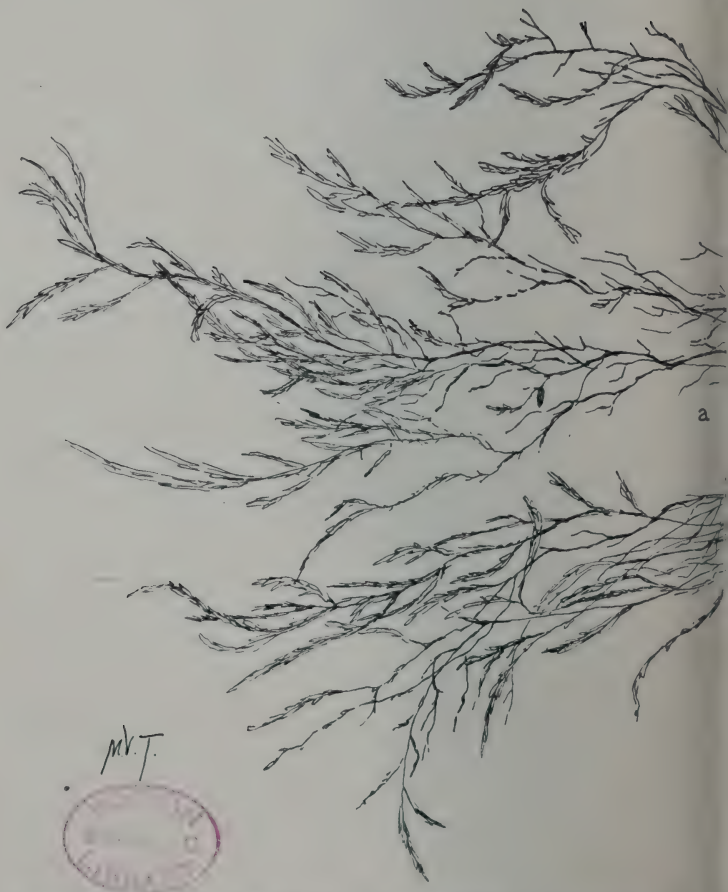


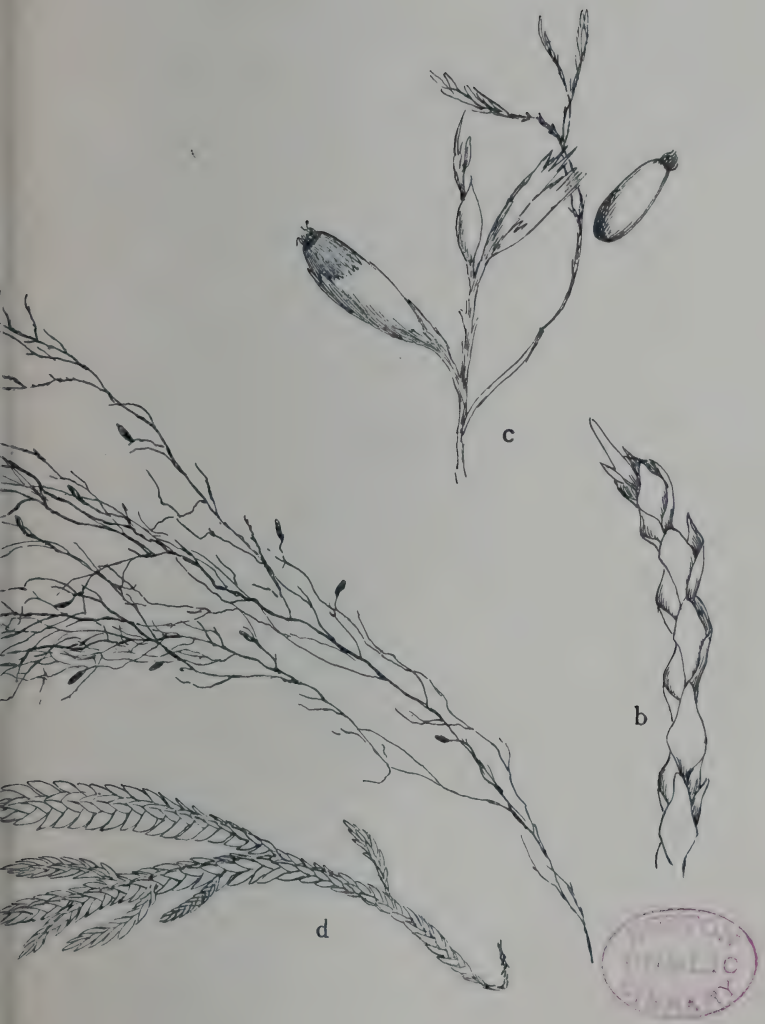
Fig. 44. a, *Leucodon brachypus* × 1. b, Leaf × 20. c, Sporophyte × 10. d, Leaf of *L. julaceus* × 20. e, Sporophyte × 10. f, Capsule × 10.

the end. The cut shows the usual position of the branches. The sporophyte takes the direction of that part of the branch from which it springs. The perichætial leaves are very long, and in one species at least, partially cover the capsule, although the seta is of considerable length. The branches, however, are very unlike those of Neckera in that they are nearly or quite terete and also julaceous.

We have two species of Leucodon that are common in portions of our range, the Northern Leucodon (*L. brachypus* Brid.), which is common in the cool forests of the North, and the Southern Leucodon [*L. julaceus* (Hedw.) Sulliv.], which is much



Explanation of Plate VIII.—a, *Fontinalis dalecarlica* × ½. b
branch of



ıch × 5. c, Portion of plant bearing capsules × 5. d, A short
igantea.

more abundant southwards, being comparatively rare in New England. The Northern Leucodon has gradually acuminate leaves, which are somewhat secund and turned towards the lower side of the branch. Its capsules are partially immersed.

The Southern Leucodon has terete julaceous branches, leaves smaller and abruptly acute, and capsules entirely free from the perichætial leaves.

THE WATER MOSSES (Fontinàlis)

ALTHOUGH mosses belonging to several other families are aquatic, the mosses of the Fontinalis Family are most emphatically entitled to the name of The Water Mosses. In the genus Fontinalis all the species are aquatic and submerged. Some grow attached to stones and sticks in swift brooks. Others are found attached to objects in ponds and sluggish streams. Rarely, if ever, are they found in stagnant water. The Water Mosses are so distinct from all others in their long slender floating stems and branches that no one can fail to recognize them. The species are, however, very difficult to determine, with one or two exceptions.

The Giant Water Moss (*Fontinalis gigántea* Sulliv.) is common in cool brooks and is most distinct by reason of its large turgid three-cornered stems and branches. The branch shown in the plate is a very short one; the branches are sometimes a foot or more long. The Giant Water Moss rarely fruits, but the Common Water Moss (*Fontinalis dalecárlica* B. & S.) is everywhere abundant and usually fruits freely, the capsules maturing in summer. As will be seen from the plate, the capsules are almost entirely covered by the perichætium and are borne on the older portions of the plant from which the leaves have fallen. One must not be too sure that he has found this species until he has studied it with a compound microscope, as there are several other common species that are not readily distinguished from it.

A NUMBERED LIST OF THE ONE HUNDRED MOSSES DESCRIBED IN THE PRECEDING PAGES SYSTEMATICALLY ARRANGED*

SPHAGNACEÆ.

1. Sphagnum acutifolium Ehrh. Acute-leaved Peat Moss.
2. S. cymbifolium (Ehrh.) Hedw. Spoon-leaved Peat Moss.
3. S. squarrosum Pers. Squarrose Peat Moss.

BUXBAUMIACEÆ.

4. Buxbaumia aphylla L. Buxbaumia.
5. Webera sessilis (Schmid.) Lindb. Webera.

GEORGIACEÆ.

6. Georgia pellucida (L.) Rab. Georgia.

POLYTRICHACEÆ.

7. Catharinea angustata Brid. Narrow-leaved Catharinea.
8. C. crispa James.
9. C. undulata (L.) W. & M. Wavy Catharinea.
10. Pogonatum alpinum (L.) Roehl. Alpine Pogonatum.
11. P. capillare (Mx.) Brid.
12. P. tenue (Menz.) E. G. Britton. Slender Pogonatum.
13. P. urnigerum (L.) Beauv. Urn-like Pogonatum.
14. Polytrichum commune L. Common Hair-cap.
15. P. juniperinum Willd. Juniper Hair-cap.
16. P. Ohioense R. & C. Ohio Hair-cap.
17. P. piliferum Schreb. Awned Hair-cap.
18. P. strictum Banks. Erect Hair-cap.

FISSIDENTACEÆ.

19. Fissidens cristatus Wils. Fissidens.

DICRANACEÆ.

20. Leucobryum glaucum (L.) Sch. White Moss.
21. Ceratodon purpureus (L.) Brid. Ceratodon.
22. Dicranella heteromalla (L.) Sch. Common Dicranella.
23. Dicranella heteromalla orthocarpa Hedw. Erect Dicranella.
24. Dicranum flagellare Hedw. Flagellate Dicranum.
25. D. fulvum Hook. Fulvous Dicranum.
26. D. fuscescens Turn. Fuscous Dicranum.
27. D. Drummondii C. Muell. Drummond's Dicranum.
28. D. scoparium (L.) Hedw. Broom Moss.

29. D. undulatum Ehrh. Wavy Dicranum.
30. Ditrichum pallidum (Schreb.) Hampe. Yellow Ditrichum.
31. D. tortile (Schrad.) Hampe. The Brown Ditrichum.
32. D. vaginans (Sulliv.) Hampe. The Dark Ditrichum.
33. Pleuridium subulatum. Common Pleuridium.
34. Trematodon ambiguus (Hedw.) Hornsch. Northern Long-necked Moss.

TORTULACEÆ.

35. Pottia truncatula (L.) Lindb.

GRIMMIACEÆ.

36. Hedwigia albicans (Web.) Lindb. Hedwigia.

ORTHOTRICHACEÆ.

37. Weissia Americana (Beauv.) Lindb. American Weissia.
38. W. coarctata (Beauv.) Lindb. Puckered Weissia.
39. W. ulophylla Ehrh. Crisped Weissia.
40. W. ulophylla crispula (Bruch.) Hammar.

SPLACHNACEÆ.

41. Splachnum ampullaceum L. Splachnum.

FUNARIACEÆ.

42. Funaria hygrometrica (L.) Sibth. Cord Moss.
43. Physcomitrium turbinatum (Mx.) Brid. Urn Moss.

BARTRAMIACEÆ.

44. Bartramia Oederi (Gunn.) Swtz. Short-leaved Bartramia.
45. B. pomiformis (L.) Hedw. Long-leaved Bartramia.
46. Philonotis fontana (L.) Brid. Philonotis.

BRYACEÆ.

47. Bryum argenteum L. Silvery Brym.
48. B. proliferum (L.) Sibth. Giant Bryum.
49. Gymnocybe palustris (L.) Fries. Gymnocybe.
50. Leptobryum pyriforme (L.) Wils. Long-necked Bryum.
51. Mnium affine ciliare (Grev.) C. M. Toothed Mnium.
52. M. Drummondii B. & S.
53. M. hornum L. Long-leaved Mnium.
54. M. punctatum L. Early Mnium.
55. M. punctatum elatum Schimp. Large-leaved Mnium.
56. M. spinulosum B. & S.
57. M. sylvaticum Lindb. Woodsy Mnium.

LESKEACEÆ.

58. Anomodon apiculatus B. & S. Common Anomodon.
59. A. attenuatus (Schreb.) Huebn. Slender Anomodon.
60. A. minor (P. Beauv.) Fuern. Blunt-leaved Anomodon.
61. Thelia asprella (Schimp.) Sulliv.
62. T. hirtella Hedw. Common Thelia.
63. T. Lescurii Sulliv.
64. Thuidium abietinum (L.) B. & S. Wiry Fern Moss.
65. T. delicatulum (L) Mitt. Common Fern Moss.
66. T. recognitum (Hedw.) Lindb.
67. T. scitum (Beauv.) Aust. The Smaller Fern Moss.

HYPNACEÆ.

68. Hylocomium proliferum (L) Lindb. Mountain Fern Moss.
69. H. triquetrum (Ehrh.) B. & S. Shaggy Moss.
70. Hypnum crista-castrensis L. Plume Moss.
71. H. curvifolium Hedw.
72. H. dilatatum Wils. Round-leaved Hypnum.
73. H. Haldanianum Grev. Common Hypnum.
74. H. imponens Hedw. Pinnate Hypnum.
75. H. reptile Mx.
76. H. Schreberi Willd. Schreber's Hypnum.
77. H. uncinatum Hedw. Hooked Moss.
78. Plagiothecium denticulatum (L.) B. & S. Slender Plagiothecium.
79. P. sylvaticum (Huds.) B. & S. Woodsy Plagiothecium.
80. Raphidostegium recurvans (Mx.) J. & S. Raphidostegium.
81. Brachythecium oxycladon (Brid.) J. & S. Long-capsuled Brachythecium.
82. B. acuminatum (Hedw.) Kindb. Erect Brachythecium.
83. B. plumosum (Sw.) B. & S.
84. B. populeum (Hedw.) B. & S.
85. B. rivulare B. & S. Rivulet Brachythecium.
86. Cirriphyllum Boscii (Schwaegr.) Grout. Spoon-leaved Moss.
87. Eurhynchium hians (Hedw.) J. & S. Light Beaked Moss.
88. Rhynchostegium rusciforme (Neck.) B. & S.
89. R. serrulatum (Hedw.) J. & S. Dark Beaked Moss.
90. Climacium Americanum Brid. American Tree Moss.
91. C. Americanum Kindbergii R. & C. Kindberg's Tree Moss.
92. C. dendroides (L.) W. & M. European Tree Moss.
93. Entodon cladorrhizans (Hedw.) C. Muell. Flat-stemmed Entodon.

94. E. seductrix (Hedw.) C. Muell. Round-stemmed Entodon.
95. Pylaisiella Schimperi (R. & C.) Grout.

NECKERACEÆ.

96. Neckera pennata (L.) Hedw.

LEUCODONTACEÆ.

97. Leucodon brachypus Brid. Northern Leucodon.
98. Leucodon julaceus. Southern Leucodon.

FONTINALACEÆ.

99. Fontinalis Dalecarlica B. & S. Common Water Moss.
100. F. gigantea Sulliv. Giant Water Moss.

*A set of 100 specimens numbered according to this list is being prepared by the author. Subscriptions $5.00, post-paid. About fifty specimens are now ready for delivery (January, 1901).

ERRATA

Page 17.—For Fig. 15 read Fig. 13.

Page 40.—Fourth line from bottom: For Schreber's Moss read Schreber's Hypnum.

Page 47.—For Fig. 59 read Fig. 39.

The following accents are either lacking or are incorrectly given:

Page 3.—Wébera. Page 11.—Leucóbryum. Page 26.—pomifórmis and Oèderi.

AN ILLUSTRATED GLOSSARY OF BRYOLOGICAL TERMS.

THIS is not intended to be an exhaustive glossary of botanical terms, but a glossary of those terms which are either confined to bryological works or are used in a somewhat different meaning when applied to mosses. Thus the common terms descriptive of leaves are omitted, except acumen and a few others that are used in a peculiar or unusual way by some authors. Very few terms are here defined that are sufficiently well explained in the common phanerogamic botanies like Gray, Wood, or Britton and Brown.

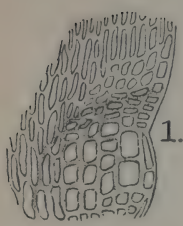
Braithwaite's British Moss Flora, Lesquereux and James' Manual, and Dixon and Jameson's Handbook of British Mosses have been largely consulted and an attempt has been made to determine the meaning of each term according to the usage of all the authors accessible.

For most of the cuts we are indebted to the kindness of Mr. H. N. Dixon, Mr. Jameson, and their publishers, who have very kindly allowed us the use of the cuts in their Handbook of British Mosses, a work which should be in the hands of every moss student whether English or American. Terms whose meaning can be made sufficiently clear by definition are not illustrated as a rule. In order to use the same figure to illustrate two or more definitions without having definition and figure too far apart, the glossary is arranged alphabetically under topics such as leaves, capsules, etc. The first section consists of those terms which apply to leaves.

TERMS USED IN DESCRIBING LEAVES.

Acumen, the gradually tapering narrow point of an acuminate leaf. (Fig. 2, *b*.)

Acuminate, a term usually applied to leaves that gradually taper to a narrow point. A few recent writers use terms as applying only to those leaves that are not uniformly narrowed and limit the term acumen to that part of the apex beyond the point where the narrowing begins to be less abrupt. According to these authors a leaf uniformly narrowed would not be acuminate, no matter how slender the apex. The author has followed this usage to some extent in previous writings, but general usage does not seem to sanction this restriction of the term.

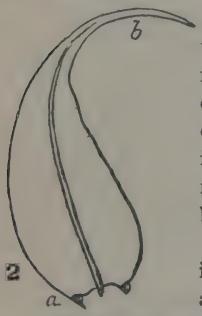

1.

Acumination, see acumen and acuminate.

Alar cells, the cells at the basal angles of the leaf, commonly different from the cells of the main part of the leaf, being shorter and often nearly square, or inflated and hyaline, and often highly colored. (Fig. 1.)

Apical cells, the cells composing the apex of the leaf. They are often broader and shorter than the cells of the middle of the leaf.

Areolation, the net-work formed by the outlines of the cells of a leaf.



2

Auricles, small lobes at the basal angles of the leaf, usually consisting of cells differing from those of the main part of the leaf in size or shape or both. (Fig. 1 and Fig. 2, *a*.) Properly used only when there is an outward curve in the outline of the leaf at the base, as in the figures, but often used loosely to denote the basal angles of widely decurrent leaves.

Basal or basilar cells, cells at the base or insertion of the leaf, often of different shape and color from those of the main part of the leaf.

Bicostate, having a double costa, which is usually much shorter than in leaves having a single costa.

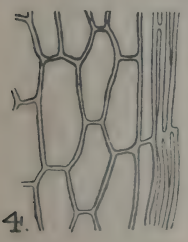
3

Bifarious, growing in two ranks.

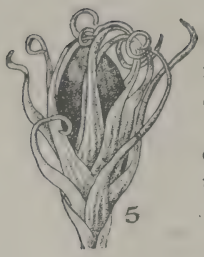
Bracts, a term applied to the leaves surrounding the reproductive organs. Those surrounding the antheridia are called perigonial bracts or leaves, and those surrounding the archegonia and base of seta are called perichætial.

Bistratose, of two layers of cells. (Fig. 3.)

Canaliculate, channelled. Applied to leaves with margins incurved, so as to give them a channel-like form; *e. g.*, the upper part of the leaves of *Dicranum fuscescens*. A more complete inrolling until the margins meet would make the leaf tubulose.


4.

Bordered, having a margin different from the rest of the leaf. In Mnium and Bryum the border consists of a few rows of greatly elongated cells, often in two or more layers. In some species of Fissidens the border is of a different color, but with little difference in cell structure. (Fig. 4.)



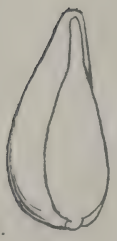
5

Circinate, curved into a circle, resembling Fig. 2, but still more incurved, so that the apex is nearly or quite bent around to the leaf base; *e. g.*, leaves of *Hypnum uncinatum*.

Cirrate or *cirrhate*, applied to leaves which curl up in drying. Cirrate leaves are more regularly curled than crispate leaves.

Cirrhose, having a wavy hair point.

Cochleariform, rounded and concave like a spoon or ladle.



6.

Complicate, folded together.

Costa, the nerve or midrib of a moss leaf.

Costate, having a costa.

Crispate or *crisped*, frizzled, curled and twisted in various ways. (Fig. 5.)

Cucullate, hood-shaped, the apex curved in like a slipper. (Apex of leaf in Fig. 6.)

Cultriform, curved like a short, wide scimitar; *e. g.*, the leaves of *Homalia trichomanoides Jamesii*.

7.

Cymbiform, boat-shaped (used by Dixon as a synonym of cucullate); *e. g.*, leaves of *Sphagnum cymbifolium*. (The whole leaf in Fig. 6.)

Dorsal, belonging to or on the back; *i. e.*, the face of a leaf remote from the stem.

Ecostate, lacking a costa.

Excurrent costa, a costa running out beyond the lamina of a leaf. (Fig. 7.)

8.

Excavate, (leaf-insertion) hollowed out in a curve.

Falcate, curved like a sickle. (Fig. 2.)

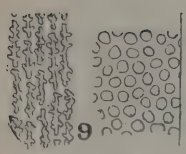
Flexuose, bent backwards and forwards, or wavy.

Hamate, or *hamulose*, curved like a hook; more sharply and abruptly curved than in *falcate* and *circinate*.

Heteromallous, (leaves or branches) turned in different directions.

Homomallous, turned in the same direction.

Imbricated, closely overlapping each other like the tiles of a roof. (Fig. 8.)



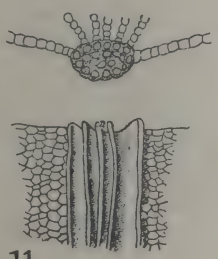
9

Incrassate, of the cell walls, thickened; of the cells, having thickened walls. (Fig. 9)

Inflated, applied to the alar cells of leaves when enlarged much beyond the size of the neighboring cells. (Fig. 10.)

Lamellæ, thin sheets or plates of tissue; *e. g.*, the plates arising from the costa of the hair-caps and their allies. (Fig. 11.)

10.



11

Lamellate, having lamellæ.

Lamina, the blade or expanded part of the leaf as distinct from the costa.

Limb, the upper part of a leaf as distinct from the leaf base.

Limbate leaf, a leaf bordered by a part of another color; *e. g.*, many species of Fissidens.

12.

Margined, see *bordered*.

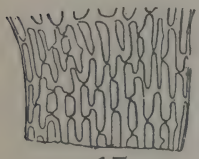
Median leaf cells, those from the middle of the leaf.

Nerve, see *costa*.

Papillæ, minute rounded or acute protuberances.

Papillose, rough with papillæ. (Fig 3.)

Paraphyllia, minute leaf-like or much-branched organs among the leaves. (Fig. 12.) *E. g.*, *Thuidium*.



13

Parenchymatous, cells with broad ends abutting on each other, not dovetailing into each other. (The large cells in Fig. 4)

Patent, spreading at an angle of 26°-45° (Braithwaite); spreading at an angle of 45° or more (Dixon).

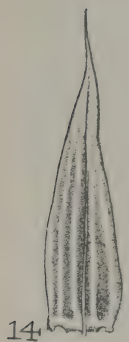
Patulous, more widely spreading than patent.

Percurrent costa, reaching to the apex of the leaf, but not beyond.

Perichætial, see *bracts*.

Perigonial, see *bracts*.

Pitted cell walls, those marked with small apertures or depressions; *e. g.*, the cell walls of the leaves of *Dicranum scoparium* and other species.



14

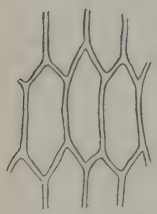
Plicate, folded in pleats or furrows; *e. g.*, leaves of Camptothecium. (Fig. 14.)

Plicæ, folds of a plicate leaf.

Pluriseriate, many ranked; *i. e.*, as applied to leaves arranged in several rows along the stem.

Porose, see pitted, with which Fig. 13 belongs.

Primordial utricle, "the first layer deposited within a cell." As applied to the cells of the moss leaf it refers to the layer of protoplasm lying next the cell wall, which often is very conspicuous when dried and shrunken away from the cell wall. As a character for use in the identification of species it is valueless, because its appearance is due to circumstances not well understood, and is frequently present in some specimens and lacking in others of the same species.



15

Prosenchymatous, (cells) with pointed ends dovetailing into each other. (Fig. 15.)

Quadrate, (cells) square or nearly so. (Fig. 1.)

Rosulate, in the form of a rosette.

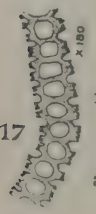
16

Rugose, wrinkled (in the case of leaves it is usually applied to transverse wrinkles); *e. g.*, leaves of *Hypnum rugosum*.

Secund, twisted or turned to one side. (Fig. 16.) *E. g.*, leaves of many *Hypnums*. Not necessarily curved as in the figure.

Striate, marked with striæ or slight furrows.

Sulcate, deeply furrowed with longitudiual channels. As applied to leaves, both *striate* and *sulcate* really refer to the fold whose concave surface is on the inner or ventral surface of the leaf.



17

Tubulose, see *canaliculate*.

Uncinate, hooked, curved back at point. (Fig. 16.)

Undulate, with an alternately concave and convex margin, wavy; *e. g.*, leaves of *Dicranum undulatum*.

Ventral surface, the surface of a leaf next the stem.

Vermicular, narrow and curved like a little worm; applied to leaf cells.

Verruculous or *verrucose*, covered with wart-like prominences. (Fig. 17.)

Vesicular, inflated like a bladder.

Wavy, see *undulate*.

TERMS USED IN CONNECTION WITH THE REPRODUCTIVE ORGANS

18.

Acrocarpous, having the sporophyte terminal on a stem or ordinary branch. Acrocarpous mosses can usually be easily distinguished by the erect habit as shown in the figure. (Fig. 18.) The old sporophyte often seems lateral in acrocarpous mosses, because the stem grows on the next year from a point just below the base of the sporophyte.

Aggregate, clustered; usually applied to two or more sporophytes from one perichætium.

Amentula, applied to the special antheridia-bearing branches of *Sphagnum*.

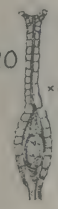
Androgynous, with antheridia and archegonia in the same cluster of leaves; *i. e.*, either synoicous or paroicous.

Antheridium, the male reproductive organ containing the antherozoids. (Fig. 19.)

Antherozoid, the small flagellate male cell which escapes from the antheridium, and in wet weather swims to the archegonium and down its neck to the egg cell in the bottom.

Archegonium, the flask-shaped female reproductive organ. (Fig. 20.) See also *antherozoid*.

19



Autoicous or *autœcious*, having male and female organs on the same plant. According to Braithwaite there are three forms.

1. *Cladautoicous*, with the male organs on a special proper branch.

2. *Gonioautoicous*, with the male organs in a bud-like cluster, and axillary on a female branch.

3. *Rhizautoicous*, male branch very short and cohering to the female by the rhizoids.

Bi-sexual, synoicous.

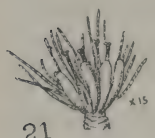
Cladocarpous, having the sporophyte terminating a short special fertile branch; somewhat like half-way between acrocarpous and pleurocarpous; *e. g.*, *Fontinalis*.

Dioicous or *dioecious*, having the male and female organs on separate plants.

Flowers, often applied to the reproductive organs.

Fruit, often applied to the sporophyte.

Gametophyte or *gametophore*, that part of the plant which bears the gametes or sexual cells. In mosses all the plant except the "fruit," or seta and capsule.

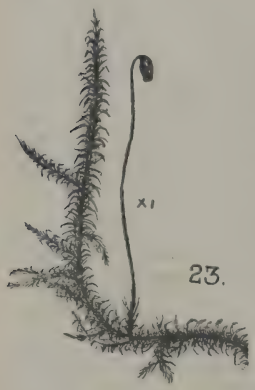


21 22

Inflorescence, often applied to the clusters of reproductive organs.

Monoicous or *monœcious*, having male and female organs on the same plant, but separate.

Oösphere, the egg cell or ovum found in the base of the archegonium. After fertilization, by union with the antherozoid, it develops into the sporophyte. (Fig. 20.)



23.

Paraphyses, joined hyaline hairs growing among the reproductive organs. (Fig. 21.)

Paroicous, having its male and female organs in the same cluster, but not mixed, the antheridia being in the axils of the perichætial bracts below the archegonia. (Fig. 22.)

Perichætium and *perigonium*, see under topic *leaves*.

Pleurocarpous, having the sporophyte lateral on a short lateral special branch. (Fig. 23.) Pleurocarpous mosses can usually be recognized by the creeping habit.

Spermatozoid, see *antherozoid*.

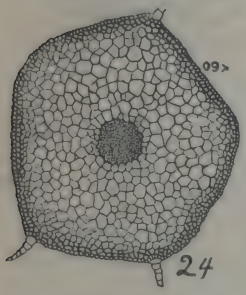
Sporophyte or *sporophore*, the spore-bearing part or generation. In mosses it consists of the seta and capsule and constitutes the so-called fruit.

Stipitate, having a short stem. Applied to antheridia and archegonia.

Synoicous or *synœcious*, having the male and female organs mixed together in the same cluster. (Fig. 21.)

TERMS USED IN THE DESCRIPTION OF THE GAMETOPHYTE, EXCLUSIVE OF THOSE ALREADY DEFINED.

Cæspitose, forming matted tufts or cushions; *e. g.*, *Leucobryum.*



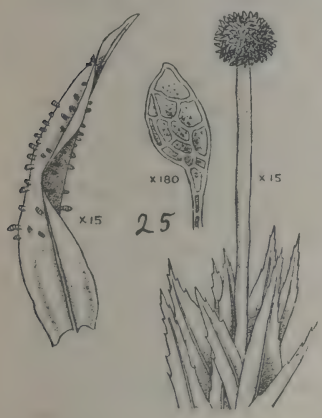
Canescent, rather hoary; *e. g.*, *Racomitrium canescens.*

Central strand. The middle of many moss stems is made up of a bundle of much narrower and more slender cells, known as the "central strand." (Fig. 24.) This is usually continuous with the midrib or costa of the leaves, much after the manner of the vascular bundles in the higher plants.

Capitulum, a rounded head.

Coma or *comal tuft*, a tuft of leaves at the top of a stem or branch.

Confervoid, formed of fine threads.



Fascicle, a bunch or cluster of leaves or branches.

Fasciculate, arranged in bunches

Fastigiate, of branches, all reaching an equal height. (Fig. 18.)

Flagella, fine string-like branches; *e. g.*, *Dicranum flagellare.*

Gemmæ, bud like bodies, capable of reproducing the plant. Sometimes borne in special heads, sometimes on the surface of the leaves. (Fig. 25.)

Gemmiferous or *Gemmiparous*, bearing gemmæ.

Gregarious, growing near together or clustered, but not in close tufts or mats.

Hygroscopic, readily absorbing water and thereby altered in form or direction.

Julaceous, smooth slender and cylindric; like a catkin or a worm.

Pinnate, having numerous equidistant spreading branches on each side, like a feather. (Fig. 26.)

Plumose, feathery.

Polygamous, with antheridia and archegonia disposed in various ways on the same plant.

Proliferous, bearing young shoots from the antheridial or archegonial cluster of leaves.

Protonema, the green, branched, alga-like threads produced from the spore and often persistent during the lifetime of the plant produced from it. Protonema and radicles differ chiefly in the presence or absence of chlorophyll, and either may develop the other. (Fig. 27.)

Pseudopodium, a leafless branch resembling a seta and often bearing gemmæ. (Fig. 25.)

Pulvinate, like a cushion.

Radicles, rootlets springing from the sides and base of stem. See also *protonema*.

Ramuli, minute branchlets.

Rhizoid, see *radicles*.

Stoloniferous stem, a slender creeping stem with minute leaves.

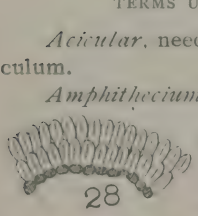
Substratum, that upon which the plant grows; *e. g.*, soil, stones, etc.

Tomentose, covered with a thick felt of radicles.

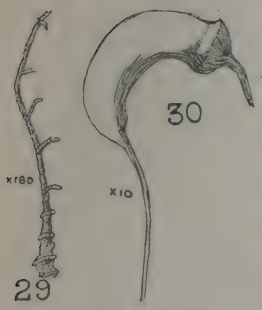
TERMS USED IN DESCRIBING THE SPOROPHYTE.

Acicular, needle-shaped. Applied to the beak of the operculum.

Amphithecium, the outer layers of cells of the sporogonium.



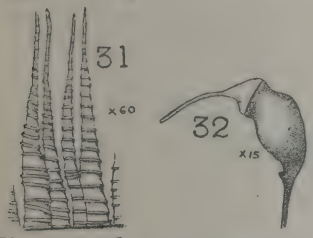
Annulus, a specialized ring of vesicular cells between the mouth of the capsule and the lid. These cells are often highly elastic and aid in removing the lid when the spores are ripe; they have a peculiar appearance, which is well illustrated in Fig. 28.



Apophysis, see *hypophysis*, the more correct term according to Braithwaite.

Appendiculate cilia, cilia with small transverse spurs attached at intervals along the margin. (Fig. 29.) As these bars sometimes extend inward instead of laterally, they are not always visible in a strictly dorsal view.

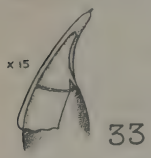
Arcuate, (capsule) bent in a curve like a bow. (Fig. 30.)



Articulate, (teeth of peristome) marked by cross-bars as in Figs. 31 and 43.

Astomous, (capsule) without a mouth. Used of capsules which have no regularly dehiscent lid.

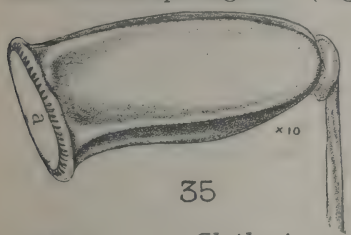
Beak, prolonged narrow tip of the operculum. The opercula in Figs. 30 and 32 are strongly beaked.



Calyptra, the thin veil or hood covering the mouth of the capsule. (Figs. 33 and 41.)

Cancellate, latticed. Used of the endostome of the Fontinalaceæ.

Capsule, the enlarged distal end of the sporophyte; it contains the spores, and is sometimes known as the sporangium. (Figs. 30, 32, 35, 39 and 40.)



Cernuous, (capsule) drooping or nodding, somewhat inclined as opposed to erect. (Fig. 35.)

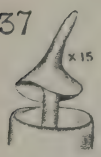
Cilia, hair-like threads of the endostome, alternating with the segments. (Fig. 29 and Figs. 36, c and 43, d.)

Clathrate, resembling lattice-work.

Cleistocarpous, capsule opening irregularly, not by a lid or valves.

Collum, the neck or tapering base of the capsule. (See Fig. 40.)

Columella, the central axis of the capsule; around it and between it and the outer wall of the capsule are borne the spores. Sometimes the



lid adheres to it and is raised upon it, as in Fig. 37.

Constricted, used of capsules that become narrowed under the mouth when dry. (Fig. 32.)

Contracted, see *constricted*.

Cribose, (peristome teeth) perforated with small apertures. (Fig. 38.)

Cucullate calyptra, a calyptra that is hood-shaped and split on one side only. (Fig. 33.)

Cygneous, (seta) curved suddenly downwards like a swan's neck.

Deoperculate, applied to a capsule after its lid has fallen off.

Dimidiate, split on one side.

Divisural line, the line down the teeth of a peristome, through which they split. (The zigzag line down the middle of the teeth and the line down the middle of the segments in Fig. 43.)

Emergent or *emersed*, half uncovered; of the capsule, when the perichætial leaves reach but do not overtop it.

Endostome, see under *peristome*.

Endothecium, the inner layers of cells of the capsule.

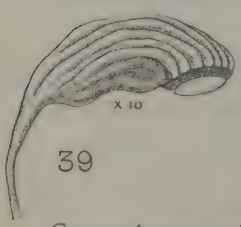
Epiphragm, a membrane covering the mouth of the deoperculate capsule; in the Polytrichums and their allies it consists of the dilated top of the columella. (Fig. 35, *a*.)

Exostome, see under *peristome*.

Exserted, elevated above the surrounding parts; of the capsule, when the perichætial leaves do not reach so high as its base.

Fenestrated, perforated.

Geniculate, (seta) suddenly bent, like a knee.



Gibbous, (capsule) more tumid or swollen on one side than on the other. Fig. 39.)

Glaucous, originally applied to plants covered with a bluish white bloom, but now applied to mosses that have that color.

Granulose or *granulated*, rough as with minute grains of sand.

Gymnostomous, without a peristome.

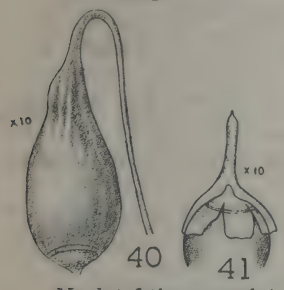
Hygroscopic, readily absorbing water and thereby altered in form or direction. *Hygrometric* is sometimes used with a similar meaning.

Hypophysis, a swelling of the seta immediately under the capsule. (Fig. 35.)

Immersed, covered up; of the capsule when the perichætial leaves project beyond it.

Leptodermous, thin coated; applied to capsules when soft and pliable.

Lid, see *operculum*.



Mamillate, or *mammillar*, (lid of the capsule) convex with a short projection in the center. (Figs. 40 and 41.)

Mitriform, (calyptra) cleft on on two or more sides, and symmetrical. (Fig. 41.)

Muricate, *Muriculate*, (spore) rough with minute sharp points.

Neck (of the capsule), the lowest part just above the point where it joins the seta. See also *collum*.

Nodose, covered with knots or prominences.

Nodulose, covered with very small knots or prominences (the cilia in Fig. 43).

Ochrea, a thin sheath around the base of the seta, terminating the vaginula.

Operculum, the lid which closes the capsule and, falling, permits the spores to escape. (Figs. 32, 37, 40.)

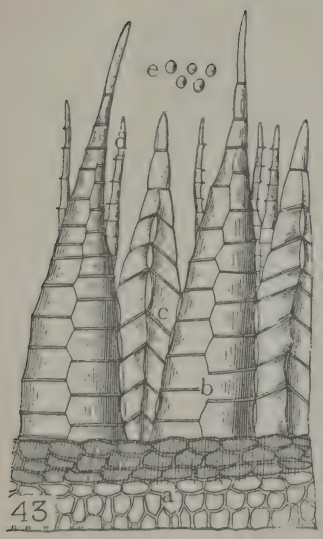
Pachydermous, thick skinned; applied to the walls of capsules or to cells when firm and resisting.

Papillose, (seta) rough with small rounded or acute protuberances. (Fig. 42)

Pedicel, see *seta*.

Pendulous, somewhat hanging or drooping; more so than in *cernous*. (Fig. 40.)

Peristome, the fringe surrounding the mouth of the capsule upon removing the lid. This fringe may consist of a single row of processes,



43

known as *teeth*, as in Fig. 31, or of a double row as in Fig. 43. In the latter case the entire fringe is still the *peristome*, but the term is also applied in a particular sense to the outer row; the outer row is often spoken of as the *exostome* (*b*), and the inner as the *endostome* (*c*). The inner row consists of as many projections as the outer, but alternating with them; these are known as *processes* or *segments* (*c*). Between the segments there are often one or more slender hair-like processes known as *cilia*. (Fig. 43, *d*; fig. 36, *c*.)

Moss peristomes, viewed with a compound microscope, are among the most beautiful of natural objects. They are not composed of cells (except in the Polytrichaceæ and a few other small families), but of thickened cell walls. The cross markings on the teeth, segments, and cilia are the lines of junction of the transverse cell walls with the longitudinal cell walls forming the peristome. The radial walls are rarely thickened so as to appear in any way; the divisural line shows the place of their attachment to the teeth and segments.

The researches of Philibert have shown that the endostome, not the exostome, corresponds to the peristome of the mosses having a single row of teeth.

Processes, see under *peristome*.

Rostellate, (operculum) with a short beak.

Rostrate, (operculum) with a long beak. (Figs. 30 and 32.)

Rough, same as *papillose*.

Scabrous, same as *papillose*.

Segments, see under *peristome*.

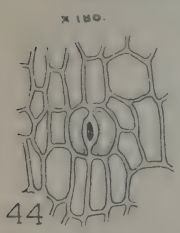
Seta, the stalk on which the capsule is borne. (Figs. 30, 35, and 40.)

Sporangium, often applied to the capsule, but by some authors restricted to the spore sac, or inner sac of the capsule containing the spores.

Spores, small round bodies contained in the capsule, serving the purpose of seeds, but in no way homologous with them. (Fig. 43, *e.*)

Sporogonium, the sporophyte or spore-bearing part of the moss.

Stegocarpous, having the capsule operculate.



44

Stomata, pores in the walls of capsules, surrounded by special guard-cells and serving the same purpose as the stomata in the epidermis of the leaves of the flowering plants. (Fig. 44.)

Struma, a goitre-like swelling on one side at the base of the capsule. (Fig. 32.)

Strumose, having a struma.

Sulcate, (capsule) deeply furrowed. (Fig. 39.)

45

Systilius, "the lid continuing fixed to the columella, and thus elevated above the capsule when dry." (Fig. 37.)

Tessellate, checkered in little squares; applied particularly to the peristomes of some of the Tortulaceæ. (Fig. 45.)

Tooth, see under *peristome*.

Trabeculate, (peristome teeth) with prominent transverse bars. (Fig. 31.)

Tumid, *turgid*, appearing as if swollen from pressure within.

46

Turbinate, top shaped; *e. g.*, capsule of *Bryum turbinatum*.

Umbonate, round with a projecting point in the center.

Urceolate, shaped like an urn or pitcher.

Vaginula, the cellular sheath surrounding the base of the seta, originally the lower part of the archegonium.

Veil, the calyptra.

Ventricose, bulging on one side. (Fig. 46.)

INDEX

(To text only)

Anomodon, - - - - - 31, 53.
Bartramia, - - - - 26, 27.
Beaked Mosses, - - - 45, 46.
Brachythecium, - - - 43, 46.
  acuminatum, - - - - 50.
  oxycladon, - - - - - 39.
  plumosum, - - - - - 44.
  populeum, - - - - - 44.
  rivulare, - - - - - 44.
Broom Moss, - - - - - 12.
Bryum, - - - 23, 24, 25, 29.
Buxbaumia, - - - - - 2, 3.
Catharinea, - - - - 8, 9, 10.
Ceratodon, - - - 14, 15, 28.
Cirriphyllum, - - 47, 36, 45.
Climacium, - - - 51, 52, 42.
Cord Moss, - - - - 22, 23.
Cylindrothecium, - - - 50.
Dicranella, - - - - - 13.
Dicranum, - 11, 12, 13, 4, 36.
Ditrichum, - - - - 15, 16.
Drummondia, - - - - 17.
Entodon, - - - - - 50, 36.
Eurhynchium, - - 45, 46, 36.
Fern Mosses - - - - 33, 34.
Fissidens, - - - - - 10, 11.
Fontinalis, - - - - - 55.
Funaria, - - - - - - 22.
Georgia, - - - - - - - 4.
Grimmia Family, - 17, 19, 49.
Gymnocybe, - - - 27, 28, 14.
Hair-cap Mosses - - 5, 6, 7.
Hedwigia, - - - 18, 19, 14, 17.
Hooked Moss, - - - - 41.
Hygrohypnum, - - - - 42.
Hylocomium, - - 34, 35, 40.
Hypnum Family, - - - 36.
Hypnum, - - - - 36, 45, 52.
  common, - - - - - 39.
  crista-castrensis, - - - 37.
  curvifolium, - - - - 38.
  dilatatum, - - - - 43, 35.
  Haldanianum, - - - 39.
  imponens, - - - - 37, 38.
  molle, - - - - - - 43.
  ochraceum, - - - - 42.
  Pinnate, - - - - 36, 38.
  reptile, - - - - - - 38.
  Schreberi, - - - - - 40.
  uncinatum, - - - - 41.
  Water loving, - - - 42, 34.
Leptobryum, - - - - - 25.
Leptotrichum, - - - - 15.
Leskea, - - - - - - 31, 53.
Leucobryum, - - - - - 11.
Leucodon, - - - - - 54, 55.
Long necked Moss, - - 16.
Mnium, - - - - - 29, 30.
Neckera, - - - - - - 53.
Orthotrichum, - - 17, 19, 20.
Peat Moss, - - - - 1, 2, 11.
Philonotis, - - - - - 27.
Plagiothecium, - - - 48, 36.
Plume Moss, - - - - 37, 38.
Pogonatum, - - - - - 7, 8.
Pohlia, - - - - - - 25.
Polytrichum, - - - - 5, 6, 7.
Physcomitrium, - - - - 23.
Pleuridium, - - - - - 16.
Pylaisia, - - - - - - 49.
Pylaisiella, - - - - 49, 36.
Raphidostegium, - - 45, 36.
Rhynchostegium, 42, 46, 36, 45.
Shaggy Moss, - - - - 35.
Sphagnum, - - - - - - 1.
Spoon-leaved Moss, - - 47.
Splachnum, - - - - 21, 16.
Tetraphis, - - - - - - - 4.
Thelia, - - - - - - - 32.
Thuidium, - - - - 33, 28.
Tree Mosses, - - - - 51, 52.
Trematodon, - - - - - 16.
Ulota, - - - - - - - 21.
Urn Moss, - - - - - - 23.
Water Mosses, - - - - 55.
Webera, - - - - - - 3.
Weissia, - - - - 19, 20, 21.
White Moss, - - - - - 11.

Boston Public Library
Central Library, Copley Square

Division of
Reference and Research Services

The Date Due Card in the pocket indicates the date on or before which this book should be returned to the Library.

Please do not remove cards from this pocket.